2014 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 13

Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program

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EXECUTIVE SUMMARY

We deployed 110 standard gill nets, 183 standard otter trawls, 87 standard trammel nets, 91 standard trotlines and 87 standard mini-fyke nets in Segment 13 during the 2014 sampling season. We also deployed 18 trotlines (910 hooks baited with nightcrawlers) and 5 non-standard 76 mm bar mesh gill nets, as part of broodstock collection efforts. A total of 12,532 fish representing 56 unique species were captured from all gear deployments. Shovelnose Sturgeon was the most commonly collected species followed by Freshwater Drum, Silver Carp and Channel Catfish.

We captured 32 Pallid Sturgeon, of which, four were suspected to be of wild origin based on genetic results. The four suspected wild Pallid Sturgeon were a size consistent with the adult life stage (> 740 mm FL). Natural recruitment of Pallid Sturgeon in Segment 13 appeared to be minimal to non-existent. Only 29 suspected wild Pallid Sturgeon have been captured in Segment 13 since the current monitoring program began in 2003. Catch rates of all Pallid Sturgeon were greater in upper portions of Segment 13, than in lower portions. This was likely an artifact of proximity to recent stocking locations. Catch per unit effort (CPUE) of Pallid Sturgeon from gill nets, trammel nets and otter trawls appeared to be slightly above long-term averages. Conversely, trotline CPUE was relatively low. Trotline catch rates have been variable since being added as a standard gear in 2010. Trotline catch rates were likely affected by confounding variables such as abundance of prey and abundance of competitors, which can lead to gear saturation. Relative condition factor K_n indicated that Pallid Sturgeon were in

relatively good condition, although K_n for larger size class fish appeared to decrease in 2014. Interestingly, K_n for quality and preferred size Pallid Sturgeon was greater in Segment 14 when compared with Segment 13. This could be due to greater abundances of prey (e.g. Sicklefin and Shoal chubs) found in Segment 14.

Catch rates for Shovelnose Sturgeon from gill nets appeared to be similar to other years, while CPUE from trammel nets and otter trawls were the highest on record. Shovelnose Sturgeon trotline CPUE in 2014 rebounded from lows in 2012 and 2013. Sub-stock (0-149 mm) and Sub-stock (150-249 mm) size class Shovelnose Sturgeon were captured during 2014, indicating recent reproduction and recruitment. Relative abundance trends across years suggested that the Shovelnose Sturgeon population in Segment 13 was relatively stable. Relative weights for preferred and memorable/trophy size Shovelnose Sturgeon continued to improve since a low point in 2011.

Catch rates for Sturgeon Chub, Sicklefin Chub and Shoal Chub continued to be relatively high since 2012. Length frequency distributions indicate that both age-0 and adult size individuals of all three chub species were relatively common in 2014. The high abundances of Sturgeon Chub collected during the sturgeon season in 2014 was driven primarily by a single sample that contained 35% of all Sturgeon Chub collected during the sturgeon season.

Catch rates of Sand Shiner (*n* = 19) appeared to improve slightly in 2014, but Sand Shiner remained relatively uncommon in Segment 13. Only 130 individual Sand Shiner have been

captured in Segment 13 since monitoring began in 2003. *Hybognathus* spp. catch rates were the highest since 2008, and most individuals were of a size consistent with age-0.

Catch per unit effort for Blue Sucker in gill nets and otter trawls were the highest ever recorded. Blue Sucker length frequency distribution suggested a few strong year classes are driving the population. Age-0 size Blue Sucker continued to be exceedingly rare in Segment 13. Blue Sucker population in lower Missouri River appeared to be stable or increasing.

Catch rates for Sauger appeared similar to other years, and age-0 size Sauger were collected. Since 2003, Sauger have never been captured in high numbers in Segment 13, but have been present every year. Invasive Asian carp were abundant in Segment 13. The high catches of age-0 size Silver Carp indicated they successfully spawned during 2014.

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Introduction

Pallid Sturgeon (*Scaphirhynchus albus)* have declined throughout the Missouri River since dam construction and inception of the Bank Stabilization and Navigation Project in 1912 (Carlson et al. 1985). Loss of habitat, reduced turbidity, increased velocity, loss of natural flows, reduction in forage, hybridization and inadequate reproduction and recruitment are factors contributing to the decline of the Pallid Sturgeon and other native species (Pflieger and Grace 1987). Surveys conducted throughout the Missouri and Mississippi rivers have found evidence of hybridization between Pallid and Shovelnose Sturgeon and a continued decline of wild Pallid Sturgeon relative abundance (Schrey et al. 2011, Grady et al. 2001, Doyle and Starostka 2003, Doyle and Starostka 2004).

An independent scientific evaluation of the condition and management of the Missouri River conducted by the National Research Council (2002) concluded that altered flow and habitat conditions associated with current management practices on the Missouri River have resulted in an unhealthy river ecosystem. Similar conclusions presented in the U. S. Fish and Wildlife Service Biological Opinion recommended, in part, that Army Corps of Engineers (COE) initiate modified flow regimes by 2003 to avoid jeopardizing the endangered Pallid Sturgeon and Least Tern (*Sternula antillarum*), and threatened Piping Plover (*Charadrius melodus*), and begin restoring altered flow and habitat conditions to promote beneficial riverine ecological processes. The COE is responsible for monitoring and evaluating biotic responses of the Pallid Sturgeon to operational and habitat changes on the Missouri River (USFWS 2000). Habitat restoration, higher spring and lower summer flows combined with adaptive management are

recommended measures to restore Pallid Sturgeon populations on the lower Missouri River. Adaptive management is an approach to natural resources management that promotes carefully designed management actions, monitoring and assessment of impacts and application of results and findings to subsequent policy and management strategies. Monitoring data for Pallid Sturgeon and other native fish species populations provides the information input necessary to support the adaptive management approach towards reducing jeopardy, and restoring habitat, hydrology, and aquatic communities in the lower Missouri River.

In response to the 2000 Missouri River Biological Opinion, the COE developed monitoring and restoration projects to avoid jeopardizing Pallid Sturgeon populations. As part of their Implementation Plan, the COE has worked with the U. S. Fish and Wildlife Service (USFWS) and State natural resource agencies to refine and conduct a Pallid Sturgeon monitoring and assessment program. The goal of the Pallid Sturgeon Population Assessment Project is to provide the information necessary to detect changes in Pallid Sturgeon and native target species populations in the Missouri River basin. Six objectives were established to address this goal:

1. Evaluate annual results and long-term trends in Pallid Sturgeon population abundance and geographic distribution throughout the Missouri River System.
2. Evaluate annual results and long-term trends of habitat usage of wild Pallid Sturgeon and hatchery stocked Pallid Sturgeon by season and life stage.
3. Evaluate population structure and dynamics of Pallid Sturgeon in the Missouri River System.
4. Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River System.
5. Evaluate annual results and long-term trends of habitat usage of the native target species by season and life stage.

6. Evaluate annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River System, where sample size is greater than fifty individuals.

Study Area

Historically, the Missouri River was wide and shallow, containing meandering channels with many islands and snags. Today, portions of the profoundly altered Missouri River and many of its tributaries are characterized by deep reservoirs and narrow, stabilized channels. Alterations to the river were executed by the COE to meet Congressionally authorized purposes. High levees and armored banks not only serve to manage the navigation channel but also to protect adjacent farm land. Revetment armors banks and rock dikes direct flows in the lower 755 miles of river to create and maintain a self-scouring channel. While current river management has addressed authorized purposes in support of flood control, navigation, irrigation, hydropower, recreational areas and stable farmland, river management has had a negative impact on the native river ecosystem largely by an altered flow regime, poor water quality and reduced habitat heterogeneity (Dieterman and Galat 2004).

Segment 13 extends from the mouth of the Grand River, at river mile 250, downstream to the mouth of the Osage River at river mile 130 (Figure 1). Major tributaries in Segment 13 include the Grand, Chariton, and Lamine rivers. Catastrophic spring floods rarely occur, though levees are occasionally overtopped or breeched allowing water to flow onto the floodplain during high flow events.

Over the last two decades, the COE has undertaken efforts to restore lost and degraded habitats by notching dikes to create shallow-water habitat (SWH), creating “pilot channels” on the floodplain to restore ecological benefits associated with side channel chutes, and by controlled spring releases from upstream dams to imitate portions of the natural hydrograph thought to cue fish spawning behavior. In recent years, much emphasis has been given to these dike modification projects and many of the existing dikes in this reach of river have been altered to promote development of SWH. Notches are now deeper and wider, following modifications initiated in 2003 and can divert water to promote erosion-deposition processes. Dike types vary in design but, in general, outside bends contain L-shaped dikes pointing downstream while dikes on the inside bend are more perpendicular to water flow, projecting straight into the channel and slightly downstream. Subsequent habitats that exist behind modified dikes vary widely and can provide habitat and refuge for fish and other aquatic species. In its current condition, the river vaguely resembles the one explored by Lewis and Clark, though some remnant historical habitat types still exist at different water stages.

Methods

Sampling was conducted in accordance with Standard Operating Procedures established by a panel of representatives from various state and federal agencies involved with Pallid Sturgeon recovery on the Missouri River (Welker and Drobish 2012). The sampling guidelines were meant to be adaptive and have been modified throughout the duration of the monitoring program to ensure sampling efficiency and scientific accuracy. For a history of modifications to the program see: USACE 2010.

Sampling Site Selection and Habitat Description

Segment 13 extends from the confluence with the Grand River (RM 250.3) to the confluence with the Osage River (RM 130.2; Figure 1). Segment 13 was divided into bends (defined as the crossing of the thalweg from one bank to the other) and 11 bends were randomly selected prior to 1 November, 2013 to be sampled as replicates, with a suite of gears. The sampling year was divided into two seasons: sturgeon season began in autumn of 2013 when water temperatures fell below 12.8˚ C and continued through 30 June 2014; fish community season began on 1 July 2014 and continued through 31 October 2014. The river was categorized into distinct habitat categories called "mesohabitats" which exist within "macrohabitats" (see Appendix B). Fish sampling effort was distributed in proportion to habitat availability within a bend. Samples that occurred outside of the predetermined (i.e., standard) sampling protocol were given a "wild" designation and not included in standard data analysis.

The macrohabitat type described the general location of the sample within a bend (e.g., inside bend, outside bend, etc.). Mesohabitat described the habitats that occurred within the respective macrohabitat (e.g., pool, channel border, etc.). Microhabitat was used to specifically characterize the individual gear deployment as it related to features within the sample area (e.g., wing dikes, sandbars, etc.). If available, all macro - and mesohabitat combinations were sampled.

In Segment 13, sampling was distributed among the following available habitats:

MACRO

CHXO (channel cross over)
ISB (inside bend)
OSB (outside bend)
CONF (confluence- area downstream of a tributary)
SCCS or SCCL (side channel connected small or large)
SCCN (side channel not connected)
TRMS or TRML (small or large tributary mouth)
TRIB (tributary)

MESO

CHNB (channel border- where depth is > 1.2 m to toe of thalweg)
POOL (scour hole)
ITIP (island tip- associated with SCCS or SCCL where the two water currents meet behind an island)
BARS (sand bar or shallow water habitat were depth is < 1.2 meters)
TLWG (thalweg- main channel between channel borders conveying majority of water)

Sampling Gear

Gill Nets

To avoid fish mortality, gill nets were only deployed when water temperatures were below 12.8^{o}C, during sturgeon season. Gill nets were anchored upstream with a heavy grappling hook-style anchor and back-anchored with a cement weight tied to a buoy. Gill nets were fished overnight with a minimum soak time of 12 hours and a maximum of 24 hours. Standard effort for gill nets was 10 sub-samples per bend. The standard gill net was an experimental mesh net

61 m long x 2.4 m in height with 7.6 m repeating 38 mm, 51 mm, 76 mm and 102 mm mesh panels.

Otter Trawls

Otter trawls were pulled downstream with a jet powered stern trawler. Otter trawls were used during both sampling seasons. Due to safety concerns, trawls were not pulled on outside bend revetment. Standard otter trawls were a minimum of 75 m and a maximum of 300 m in distance. The standard otter trawl had a width of 4.9 m, height of 0.9 m and a length of 7.6 m. The custom Skate design (Innovative Nets Systems; Greg Faulkner) consisted of an outer mesh of # 9 Sapphire® mesh (38 mm stretch), and a cod end with 6.35 mm mesh. Standard effort for otter trawls was eight sub-samples per bend.

Trammel Nets

One-inch (25.4 cm) trammel nets were deployed perpendicular to the current from the boat bow with a 10-meter lead line. Orientation of the net was maintained by pulling the net back to a perpendicular position when necessary. Trammel nets were fished in moderately shallow water away from eddies which could tangle the net. Trammel nets were only used during fish community season. Standard trammel net drifts were a minimum of 75 m and a maximum of 300 m. The standard trammel net was 38.1 m long with a 1.8 m outer wall and a 2.4 m inner wall. The inner mesh was 25.4 mm bar mesh and the outer wall was 203 mm bar mesh. Standard effort for trammel nets was eight sub-samples per bend.

Mini-Fyke Nets

Mini-fyke nets were deployed during fish community season. Mini-fykes were set on mud flats behind dikes and on sand bars adjacent to the main-channel. Steep slopes and shallow sand bars may have affected the efficiency of this gear. In many cases, the gear was set close to the bank behind bars and the lead wing was not fully extended because of the steep slope of the bank or the velocity of the water. Standard mini-fyke nets had two 1.2 m by 0.6 m rectangular steel frames and two 0.6 m circular hoops. The lead was 4.5 m long and 0.6 m high. The net was made of 3 mm "ace" type nylon mesh, coated in green latex net dip. Standard effort for mini-fyke nets was eight sub-samples per bend.

Trotlines

Trotlines were set similar to gill nets and in similar habitat types. A heavy grappling hook-style anchor was attached on the upstream end and the line was back-anchored with a cement weight tied to a buoy. Hooks on 35 cm tuna leader were attached to the mainline using ganion clips. Forty 3/0 circle hooks baited with earthworms, were attached per 61 m of mainline. On average, 320 hooks were deployed per bend. Trotlines were fished overnight with a minimum soak time of 12 hours and a maximum of 24 hours. Standard effort for trotlines was eight sub-samples per bend. Refer to Appendix C for additional detailed gear information.

Data Collection and Analysis

Associated Environmental Data

Latitude and longitude (decimal degrees), temperature (˚C) and depth (meters) (beginning, mid-point and end for all gears except mini-fykes; where depth was measured at the opening/box) were taken for each sample. In addition, turbidity (NTU) and velocity (m/s) samples were collected randomly from 25% of the mesohabitat types within each macrohabitat using Hach Model 2100P turbidimeter and Marsh-McBirney Flomate 2000 velocity meter. Water column velocity was measured at bottom, 80% and 20% of the depth. All habitat data were collected when Pallid Sturgeon were encountered.

Species Data and Genetic Verification

The Pallid Sturgeon Population Assessment Team selected eight target species that were either thought to be important forage species or were a potential surrogate species for Pallid Sturgeon (Appendix A). The eight target species were: Shovelnose Sturgeon (*S. platorynchus*), Sturgeon Chub (*Macrhybopsis gelida*), Sicklefin Chub (*M. meeki*), Shoal Chub (*M. aestivalis*), Sand Shiner (*Notropis stramineus*)*, Hybognathus* species (Western Silvery Minnow *H. argyritis*, Brassy Minnow *H. hankinsoni*, and Plains Minnow *H. placitus*), Blue Sucker (*Cycleptus elongatus*), and Sauger (*Sander canadense*). Fork length (mm FL) and weight measurements (g) were collected on Pallid Sturgeon and Shovelnose Sturgeon, and total length (mm) and weight (g) were collected on Blue Sucker and Sauger. A series of additional measurements were taken on Pallid Sturgeon and their suspected hybrids using Sheehan's index for verification (Sheehan et al. 1999). Sturgeon were deemed hybrid when they were verified to be within the hybrid range (-0.50 to

+0.60) on Sheehan's Character Index (CI) scale. Passive Integrated Transponder (PIT) tags were implanted under the dorsal fin of Pallid Sturgeon, hybrids (< 0.5 CI) and Lake Sturgeon. Additionally, fin clips were collected from Pallid Sturgeon and hybrids to be analyzed for genetic purity, as well as hatchery origin, and digital images were taken for documentation. All Pallid Sturgeon that were captured with no evidence of previously being tagged, or otherwise could not be positively identified as being of hatchery or wild origin, were deemed "unknown" until genetic verification. All Pallid Sturgeon deemed "wild" have been genetically verified as not being of hatchery origin, and are presumed to be wild. Length measurements only were taken from smaller target species (i.e. chub species, Sand Shiner, and *Hybognathus* species). Length measurements were collected on a sub-sample of non-target species (25 individuals); above that threshold, a count of individuals by species was recorded.

Catch Per Unit Effort

Catch per unit of effort (CPUE) was calculated as fish per 100 meters for active gears (otter trawl and trammel net). Gill net effort was calculated as fish per 100 feet (30.48 m) of net set overnight (less than 24 hours). Because standard gill nets used in Segment 13 were 200 feet (60.96 m) long, CPUE was calculated for the net and divided by two. Mini-fyke nets were calculated as fish per overnight set. Trotline effort was calculated as fish per 20 hook night. Samples that occurred outside of the "standard" gear deployment protocol, or samples that occurred in "non-random" bends were excluded from CPUE calculations. These data were, however, included in length frequencies, relative condition and population structure calculations.

Condition

Relative condition (a measure of a fish's plumpness) of Pallid Sturgeon was calculated using K_n= (W / W'), where W is weight of the individual and W' is the length-specific mean weight predicted by the weight-length equation calculated for that population. We used the weight-length regression: $\log_{10} W' = -6.2561 + 3.2932 * \log_{10} L$ ($r^2 = 0.98$) as defined by Shuman et al. (2011) where L is the length at capture (mm). Relative weight ($W_r = 100 \cdot W/W_s$; where W is the observed weight in grams and W_s is the length-specific standard weight value) was calculated for all Shovelnose Sturgeon captured in Segment 13. We used the standard weight equation: $\log_{10} W_s = -6.287 + 3.330 \log_{10}$FL where FL is fork length (mm) as proposed by Quist et al. (1998).

Stock Densities

Stock densities were calculated to assess Pallid and Shovelnose Sturgeon population structure. Proportional size distribution (PSD) is the proportion of fish of a selected size group in a stock and, in general, indicates health of fish populations relative to reproductive potential and age of fish (Gablehouse 1984). Length categories are based on a percentage of length of the largest known Pallid Sturgeon, and are described as follows (Shuman et al. 2006): sub-stock fork length < 330 mm, stock fork length 330-629 mm, quality fork length 630-839 mm, preferred fork length 840-1,039 mm, memorable fork length 1,040- 1,269 mm and trophy fork length > 1,270 mm; sub-stock were further divided into 0-199 and 200-329 mm FL groups. Length categories based on a percentage of length of the largest known Shovelnose Sturgeon are as follows (Quist et al. 1998): sub-stock fork length < 250 mm, stock fork length 250 – 379 mm, quality fork

length 380 – 509 mm, preferred fork length 510 – 639 mm, memorable fork length 640 – 809 mm and trophy fork length > 810 mm; sub-stock were further divided into 0-149 and 150-249 mm FL groups.

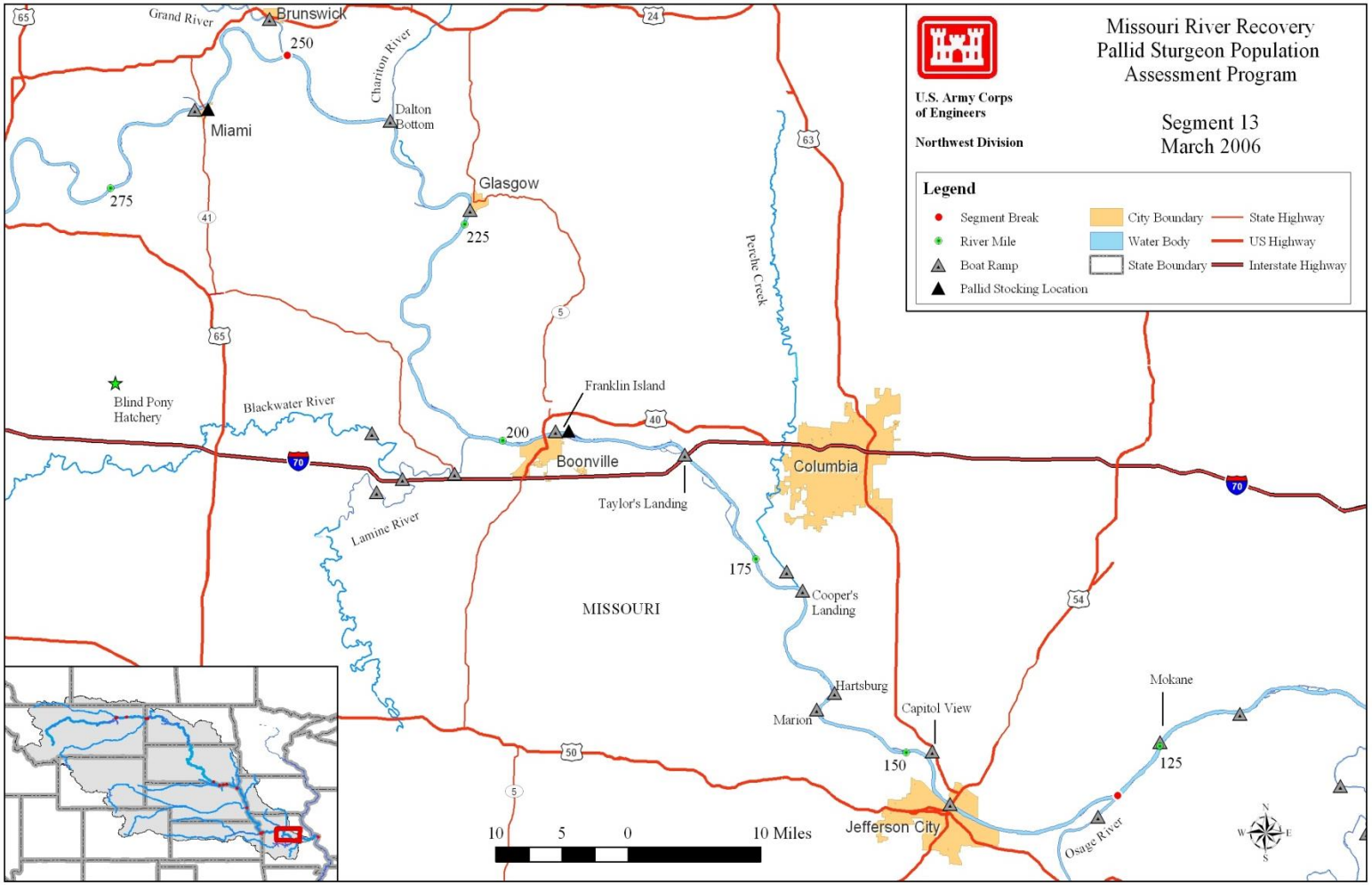

Figure 1. Map of Segment 13 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for Pallid Sturgeon. Segment 13 encompasses the Missouri River from the Osage River (River Mile 130) to the Grand River (River Mile 250).

Results

Effort

We completed 100% of the targeted standard sampling effort on eleven randomly selected bends, with deployment of 110 standard gill nets, 87 trammel nets, 183 otter trawls, 87 mini-fyke nets and 91 trotlines. We also deployed 18 trotlines (910 hooks baited with nightcrawlers) and 5 non-standard 76 mm bar mesh gill nets, as part of broodstock collection efforts. The ISB macrohabitat was most frequently sampled as it accounted for 55% of gill net, 84% of trammel net, 57% of trotline, 53% of mini-fyke net, and 75% of otter trawl standard efforts distributed in Segment 13 during 2014, and is reflective of the prevalence of ISB macrohabitats in Segment 13. Other macrohabitats sampled frequently included CHXO and OSB. Macrohabitats SCCL, SCCS, TRML, and TRMS, were sampled when encountered, but the low number of gear deployments in these habitats is reflective of the relative scarcity of these habitats in bends randomly selected for 2014 (Table 1).

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 13 on the Missouri River during the sturgeon season and fish community season in 2014. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean deploy-ments	Macrohabitat[a]													
			BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																	
Gill Net	11	10.00	N-E	29	N-E	N-E	N-E	N-E	N-E	60	17	2	0	N-E	2	0	N-E
Otter Trawl	11	8.55	N-E	19	N-E	N-E	N-E	N-E	N-E	70	3	2	0	N-E	0	0	N-E
Fish Community Season																	
1.0” Trammel Net	11	7.91	N-E	14	N-E	N-E	N-E	N-E	N-E	73	0	0	0	N-E	0	0	N-E
Mini-Fyke Net	11	7.91	N-E	16	N-E	N-E	N-E	N-E	N-E	46	16	1	3	N-E	0	5	N-E
Otter Trawl	11	8.09	N-E	16	N-E	N-E	N-E	N-E	N-E	68	0	3	0	N-E	2	0	N-E
Both Seasons																	
Trot Lines	11	8.27	N-E	22	N-E	N-E	N-E	N-E	N-E	52	13	2	0	N-E	2	0	N-E

[a] Habitat abbreviations and definitions presented in Appendix B.

Pallid Sturgeon

We collected 32 Pallid Sturgeon during 2014 in Segment 13 (28 in standard gear and 4 in non-standard gears). Pallid Sturgeon were collected in eight of the eleven randomly selected bends. Pallid Sturgeon were more frequently collected from upstream portions of Segment 13 (Figure 2). Most Pallid Sturgeon were of hatchery origin; however four suspected wild Pallid Sturgeon were captured. Pallid Sturgeon were found in every macrohabitat sampled except SCCL, SCCS, and TRMS which combined represented only 4% of all gear deployments. The majority (63%) of Pallid Sturgeon were captured from ISB – CHNB habitats where a majority (66%) of our gear deployments occurred. Bottom current velocities where Pallid Sturgeon were captured ranged from 0.02 to 1.02 m/s, whereas bottom velocity at all gear deployments ranged from 0.00 to 1.50 m/s. Water depth where Pallid Sturgeon were captured ranged from 0.9 to 6.5 m across all habitat types sampled, whereas water depth at all gear deployments across habitats ranged from 0.4 to 10.7 m (Table 2). Water temperatures where Pallid Sturgeon were captured ranged from 1.0 to 30.0˚C. Mean depth of gear deployments yielding Pallid Sturgeon in the ISB-CHNB mesohabitat was similar to mean depth for all gear deployments in the ISB-CHNB mesohabitat. Mean velocity of gear deployments yielding Pallid Sturgeon in the ISB-CHNB mesohabitat was 14% slower than all gear deployments at ISB-CHNB where velocity was measured (Table 2).

We captured 28 Pallid Sturgeon of hatchery origin, representing ten different year classes. The 2011 year class was the most frequently represented, with 9 individuals captured. The number of 2002 year class declined from 19 in 2013 to only 4 in 2014. In 2014, Pallid Sturgeon captured

from the 2002 year class had a mean length of 802 mm FL, weight of 2,062 grams and mean K_n of 0.92. Pallid Sturgeon captured from the 2011 year class had a mean length of 495 mm FL, weight of 406 grams and Mean K_n of 0.97 Growth rates across year classes ranged from 0.10 to 0.17 mm/d (Table 3). Mean K_n was equal to or greater than 0.90 for all year classes except for 2008 (0.81).

No sub-stock size (0-199 mm) or sub-stock (200-329 mm) Pallid Sturgeon were captured in 2014. Preferred size Pallid Sturgeon comprised 41% of the catch during the sturgeon season in 2013, but only 16% in 2014. Stock size Pallid Sturgeon dominated the catch during both the fish community and sturgeon seasons in 2014 (Figure 3). All stock size Pallid Sturgeon captured in 2014 were of hatchery origin. A preferred size Pallid Sturgeon was captured in Segment 13 during the 2014 fish community season for the first time. No memorable/trophy size Pallid Sturgeon were captured.

In 2014, mean relative condition factors (K_n) ranged from 0.91 for preferred size to 0.97 for stock size. Between years 2003-2014, K_n factors have typically been above 0.90 across all size classes (Figure 4).

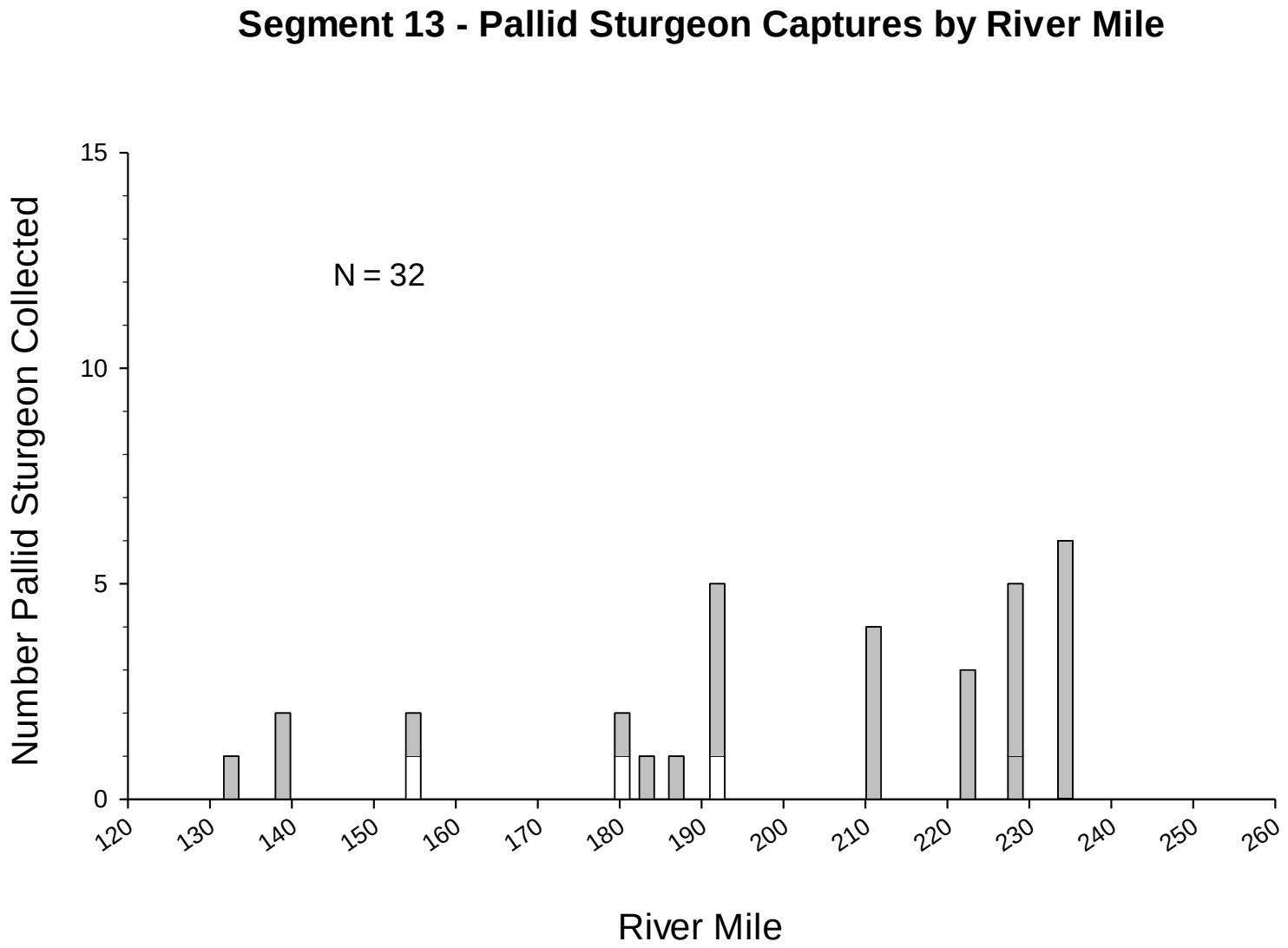

Figure 2. Distribution of Pallid Sturgeon captures by river mile for Segment 13 of the Missouri River during 2014. White bars represent wild Pallid Sturgeon captures, gray bars represent hatchery-reared Pallid Sturgeon and cross-hatched bars represent unknown Pallid Sturgeon. Figure includes all Pallid captures including non-random and wild samples.

Table 2. Pallid Sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2014. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. Table includes all Pallid Sturgeon captures including non-random samples.

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (^{o}C)		Turbidity (ntu)		Total Pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
CHXO	BARS	0.6 (0.4-0.9)		0.06 (0.00-0.14)		25.9 (15.0-29.0)		268 (52-985)		
	CHNB	3.5 (1.3-6.7)	3.0 (2.4-4.6)	0.52 (0.03-1.50)	0.54 (0.25-0.92)	17.7 (1.0-30.0)	12.5 (8.0-27.0)	240 (27-1452)	159 (24-508)	7
	ITIP									
	POOL	6.0 (2.2-10.7)	2.6 (2.6-2.6)	0.13 (0.00-0.58)		12.2 (1.3-25.0)	1.7 (1.7-1.7)	301 (37-1498)		1
	TLWG									
CONF	BARS									
	CHNB									
	ITIP									
	POOL									
	TLWG									
ISB	BARS	0.6 (0.2-1.1)		0.21 (0.00-0.50)		25.9 (15.0-29.0)		193 (42-643)		
	CHNB	3.1 (0.9-8.6)	3.1 (0.9-6.0)	0.62 (0.02-1.15)	0.72 (0.35-1.02)	19.9 (1.0-30.0)	15.6 (1.0-30.0)	301 (30-2000)	198 (30-1384)	20
	ITIP									
	POOL	4.4 (1.5-9.6)	3.2 (3.2-3.2)	0.46 (0.12-0.80)	0.35 (0.35-0.35)	9.5 (1.0-20.0)	12.5 (12.5-12.5)	73 (33-138)	68 (68-68)	1
	TLWG									
OSB	BARS	0.6 (0.4-0.9)		0.02 (0.02-0.02)		27.9 (26.0-29.0)		338 (59-743)		
	CHNB	3.8 (2.0-4.7)	4.7 (4.6-4.7)	0.15 (0.08-0.24)	0.10 (0.08-0.11)	10.3 (1.8-12.8)	12.6 (12.4-12.7)	124 (64-472)	110 (89-132)	2

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (^{o}C)		Turbidity (ntu)		Total Pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	ITIP									
	POOL	4.6 (1.7-6.5)	6.5 (6.5-6.5)	0.13 (0.02-0.33)	0.02 (0.02-0.02)	11 (1.0-20.0)	11.8 (11.8-11.8)	94 (35-312)	173 (173-173)	1
	TLWG									
SCCL	BARS	0.8 (0.7-0.8)		0.50 (0.50-0.50)		26.0 (25.0-27.0)				
	CHNB	3.5 (1.0-5.4)		0.52 (0.32-0.70)		26.0 (25.0-27.0)		89 (85-97)		
	ITIP									
	POOL									
	TLWG									
SCCS	BARS	0.2 (0.1-0.2)				27.0 (27.0-27.0)				
	CHNB									
	ITIP									
	POOL									
	TLWG									
SCN	BARS									
	CHNB									
	ITIP									
	POOL									
	TLWG									
TRML	BARS									

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (^{o}C)		Turbidity (ntu)		Total Pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
TRMS	CHNB	4.9 (2.2-7.6)				20.0 (19.0-21.0)		597 (597-597)		
	ITIP									
	POOL	5.4 (3.9-6.9)		0.05 (0.01-0.08)		9.5 (1.8-12.5)		94 (88-98)		
	TLWG									
	BARS	0.6 (0.6-0.7)		0.12 (0.10-0.14)		28.2 (27.0-29.0)		426 (138-732)		
WILD	CHNB									
	ITIP									
	POOL									
	TLWG									
	BARS									
	CHNB									
	ITIP									
	POOL									
	TLWG									

Table 3. Mean fork length, weight, relative condition factor (K_n) (±2 SE) and absolute growth rates for hatchery-reared Pallid Sturgeon captures by year class at the time of stocking and recapture during 2014 from Segment 13 of the Missouri River. Relative condition factor was calculated using the equation in Shuman et al. (2011). Table includes all hatchery-reared Pallid Sturgeon captures including non-random and wild samples.

Year Class	N	Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
2001	2	230			721	1800.0	0.97	0.16	
±2SE.					447	2740.0	0.11		
2002	4	294			802	2062.5	0.92	0.12	
±2SE		21			167	1045.6	0.07	0.05	
2003	2				777	1710.0	0.93		
±2SE					53	440.0	0.032		
2005	2	345	185	1.47	648	940.0	0.94	0.10	0.28
±2SE					45	0.0	0.22		
2006	2				541	520.0	0.94		
±2SE					48	60.0	0.17		
2007	1	235	43	1.21	463	380.0	1.14	0.10	0.16
±2SE									
2008	2				624	760.0	0.81		
±2SE					172	600.0	0.06		
2009	3	272	53	0.92	540	496.7	0.90	0.17	0.26
±2SE					28	63.6	0.08		
2010	1				500	460.0	1.07		
±2SE									
2011	9				495	405.6	0.97		
±2SE					15	45.6	0.04		

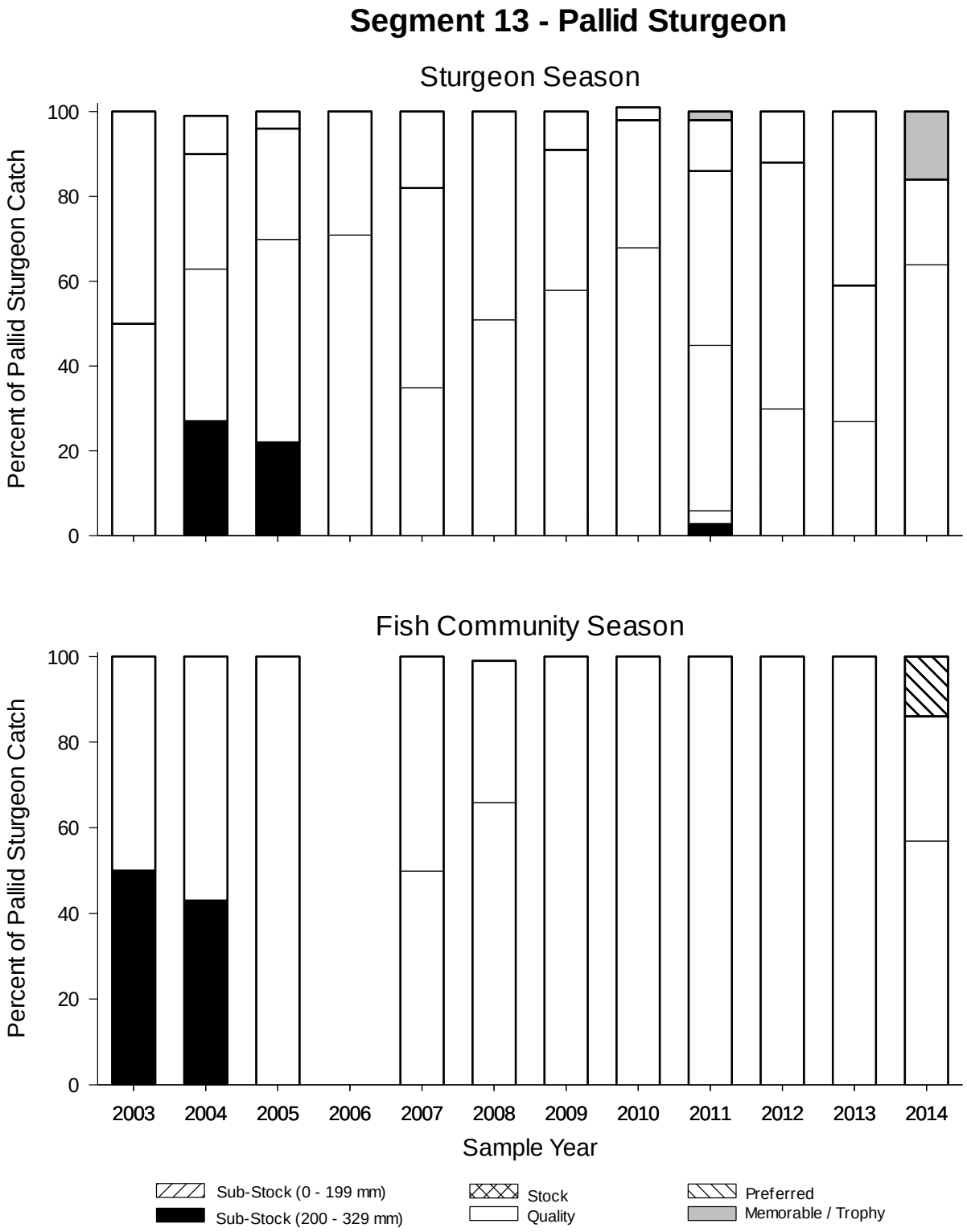

Figure 3. Incremental proportional size distribution (PSD) for all Pallid Sturgeon captured with all gear by length category from 2003-2014 in Segment 13 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

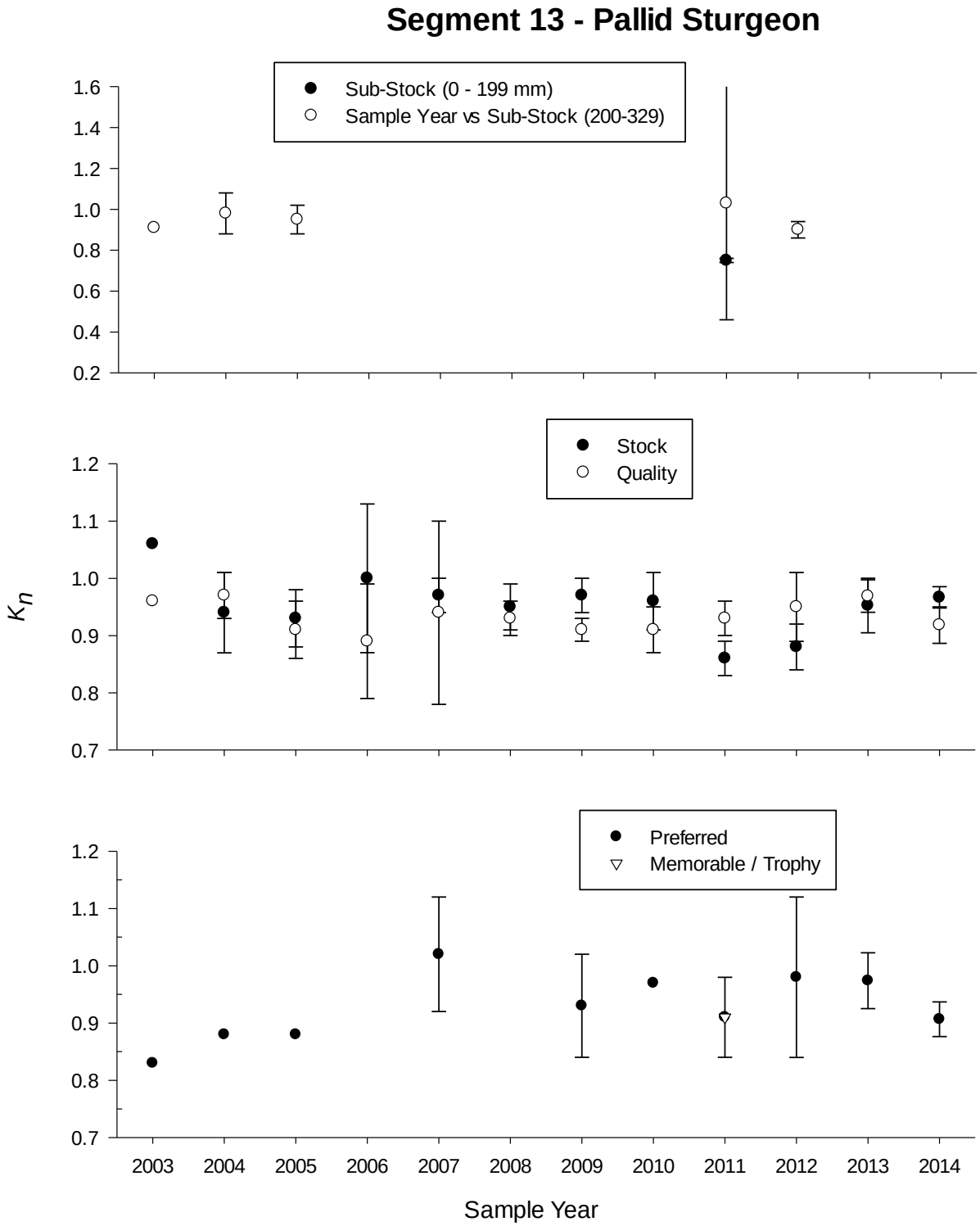

Figure 4. Relative condition factor (K_n) for all Pallid Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

Year comparisons, Gear evaluation and Habitat associations

Mean Pallid Sturgeon CPUE for gill nets in 2014 (0.05 fish/net night ± 0.03 2SE) was similar to 2012 and 2013, but was nearly twice as great when compared to any year from 2003-2011 (Figure 5, Appendix F1). Standard gill nets captured one presumed wild Pallid Sturgeon and eleven hatchery reared Pallid Sturgeon. Five Pallid Sturgeon (all hatchery origin) were captured in trammel nets in 2014, for a mean CPUE of 0.05 fish/100 m ± 0.05 2SE (Figure 6, Appendix F2). One Pallid Sturgeon was captured in otter trawls during the sturgeon season (0.006 fish/100 m ± 0.011 2SE) and two were captured during the fish community season (0.010 fish/100 m ±0.014 2 SE). One presumed wild Pallid Sturgeon was caught with otter trawls (Figure 7, Appendix F3). No Pallid Sturgeon were caught with mini-fyke nets (Appendix F4). Mean Pallid Sturgeon CPUE for trotlines in 2014 (0.04 fish/20 hooks ± 0.04 2SE) was similar to 2012, but only half as great as 2013 (Figure 8, Appendix F5). Two presumed wild Pallid Sturgeon were captured with trotlines.

No sub-stock (0-199 mm FL) size (Table 4) and no sub-stock (200-329 mm FL) size Pallid Sturgeon were captured in Segment 13 during 2014 (Table 5). Seventeen stock size Pallid Sturgeon were captured. Gill nets and trotlines captured equal number of stock size Pallid Sturgeon (Table 6). Eleven quality size and greater Pallid Sturgeon were captured. Gill nets caught the most (*n* = 6) quality size and greater Pallid Sturgeon (Table 7). Mean length of Pallid Sturgeon captured with gill nets was 672 mm FL, compared to 597 mm FL with trotlines. Gill nets captured the most (*n = 12*) Pallid Sturgeon (Table 8). Pallid Sturgeon collected in Segment 13 during 2014 ranged in length from 463-944 mm FL. More than half the sample (59%) was

comprised of hatchery origin Pallid Sturgeon less than 600 mm FL (Figure 9). Four presumed wild Pallid Sturgeon were captured in 2014 (Figure 10). In contrast, 28 hatchery reared Pallid Sturgeon were captured. All four wild Pallid Sturgeon were longer than 740 mm FL.

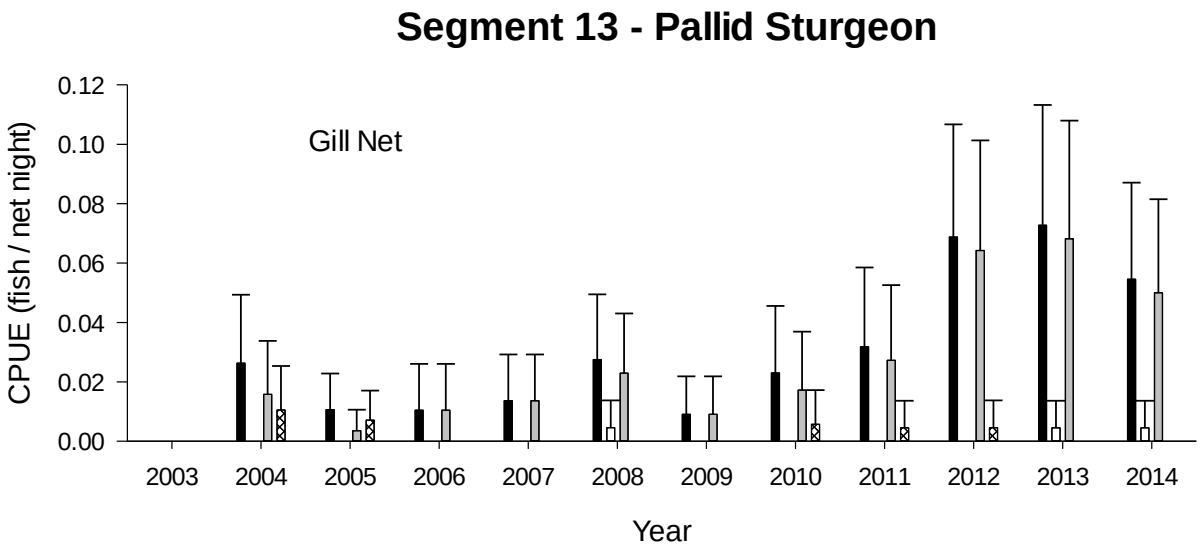

Figure 5. Mean annual catch per unit effort (±2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using gill nets in Segment 13 of the Missouri River from 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

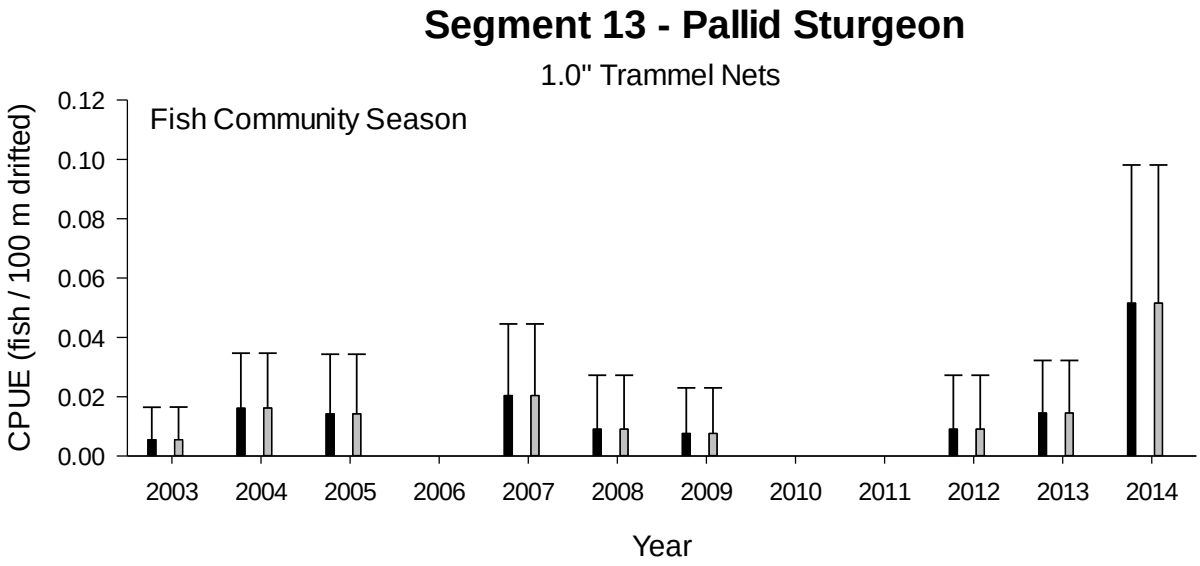

Figure 6. Mean annual catch per unit effort (±2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using 1.0" trammel nets in Segment 13 of the Missouri River from 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

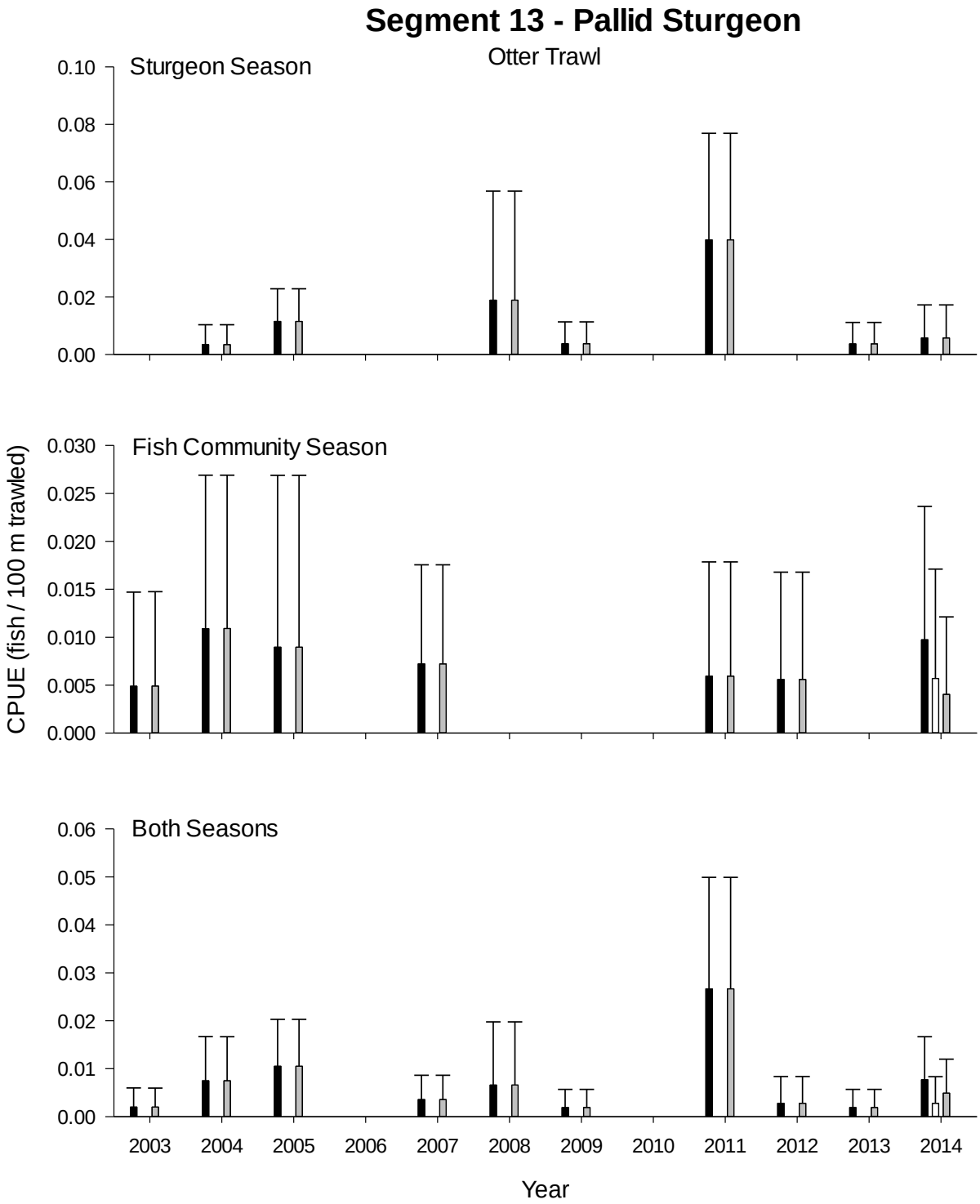

Figure 7. Mean annual catch per unit effort (± 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using otter trawls in Segment 13 of the Missouri River from 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

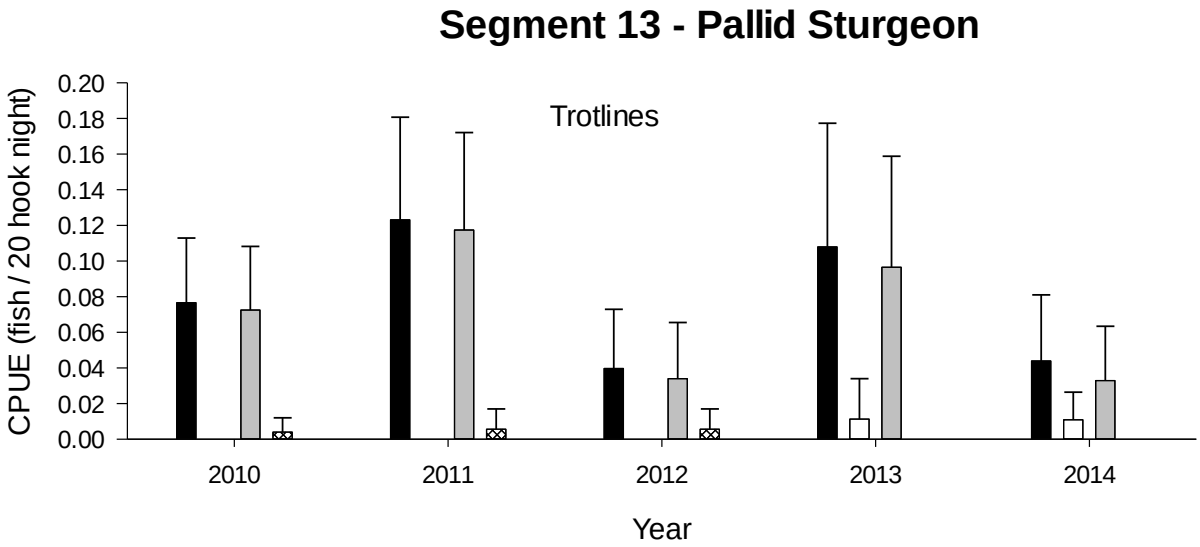

Figure 8. Mean annual catch per unit effort (±2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using trot lines in Segment 13 of the Missouri River from 2010-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

Table 4. Total number of sub-stock size (0-199 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 5. Total number of sub-stock size (200-329 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 6. Total number of stock size (330-629 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	6	N-E	50	0	N-E	N-E	N-E	0	50	0	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	3	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	6	N-E	50	0	N-E	N-E	N-E	0	50	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 7. Total number of quality size and greater (≥630 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	6	N-E	17	0	N-E	N-E	N-E	0	67	17	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	2	N-E	50	0	N-E	N-E	N-E	0	50	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	2	N-E	0	0	N-E	N-E	N-E	0	50	50	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	0	0	0

Table 8. Total number of Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	12	N-E	33	0	N-E	N-E	N-E	0	58	8	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	5	N-E	20	0	N-E	N-E	N-E	0	80	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	2	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	8	N-E	38	0	N-E	N-E	N-E	0	50	13	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

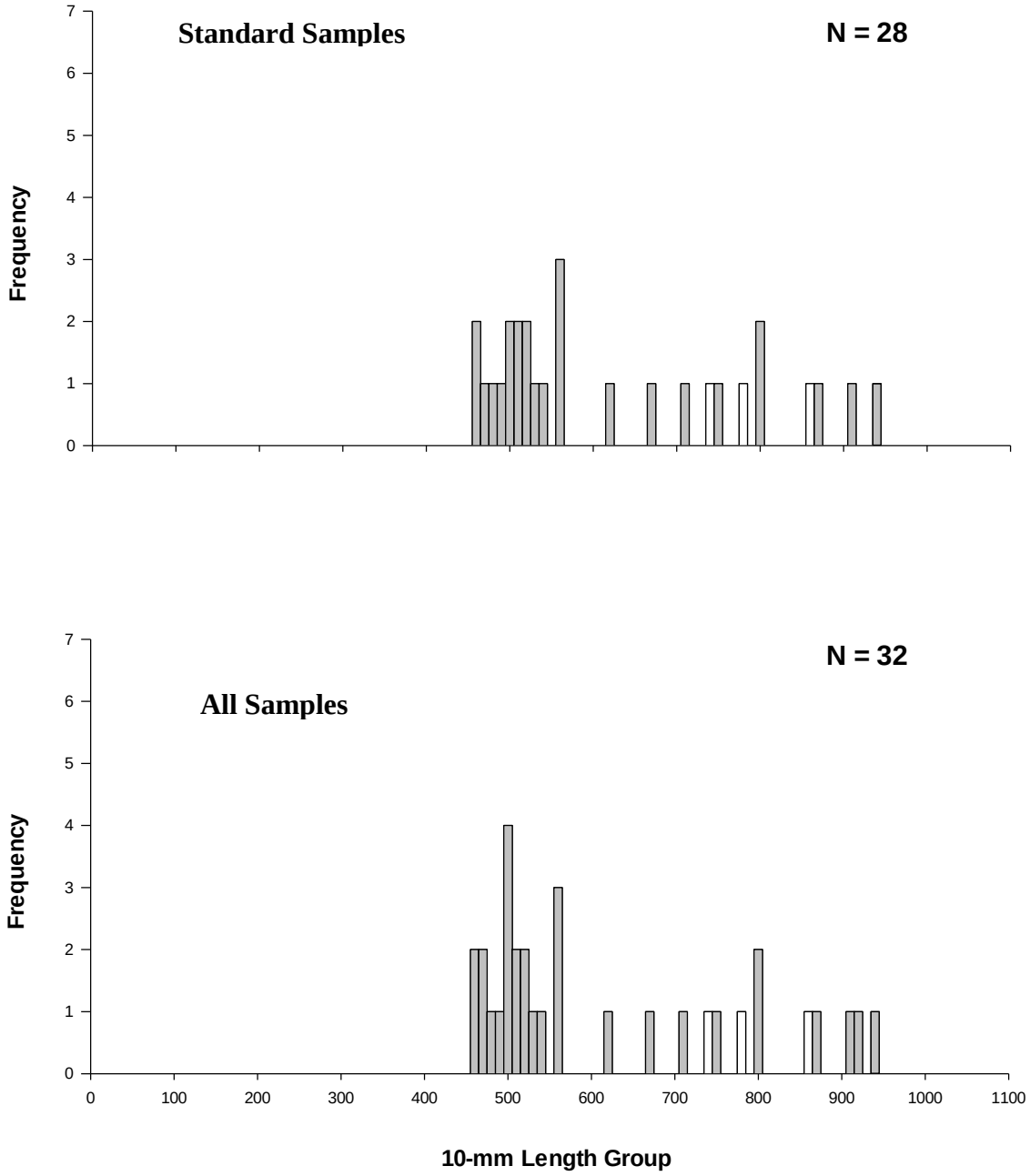

Figure 9. Length frequency of Pallid Sturgeon captured in Segment 13 of the Missouri River during 2014. White bars represent wild Pallid Sturgeon captures, gray bars represent hatchery-reared Pallid Sturgeon and cross-hatched bars represent unknown Pallid Sturgeon. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

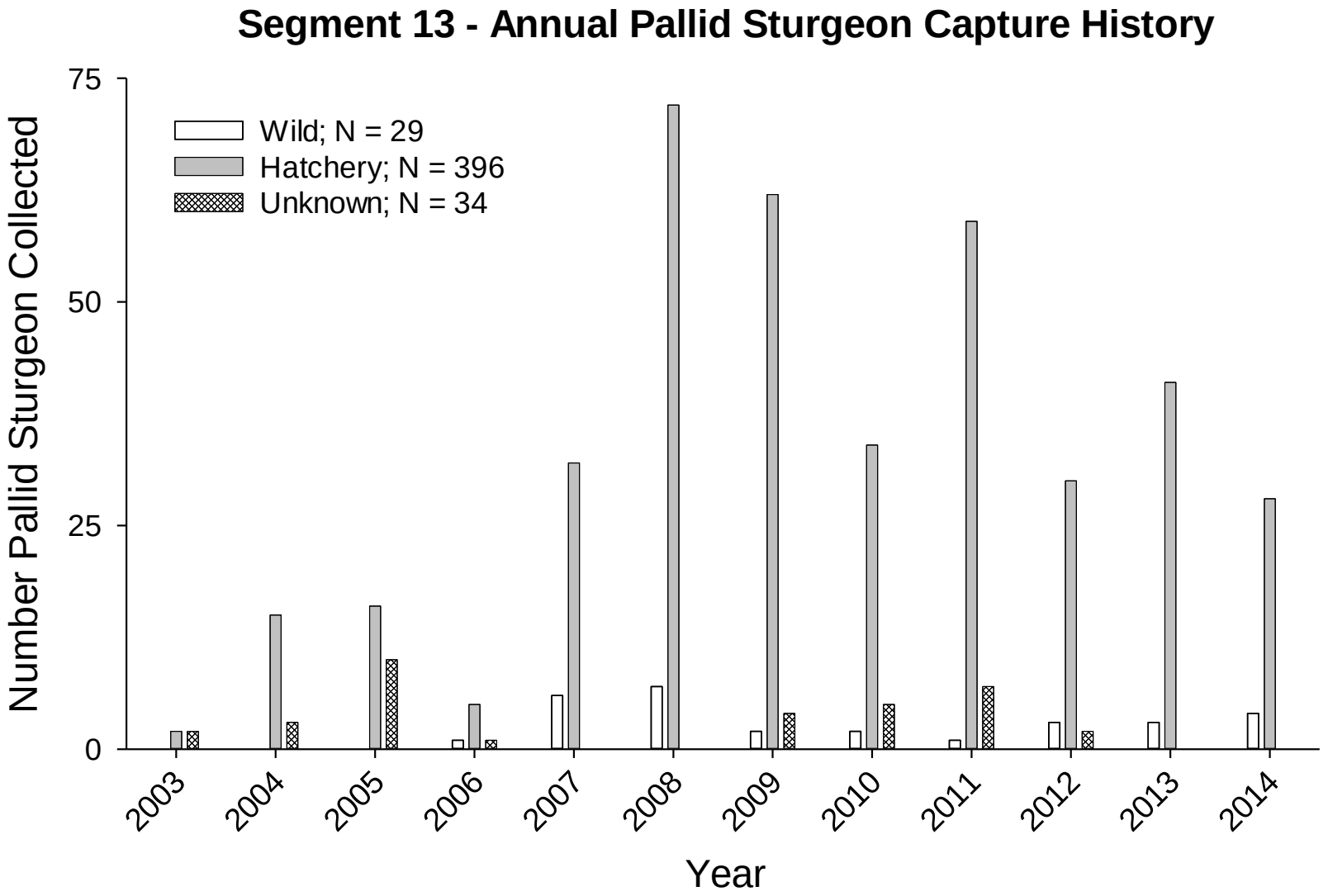

Figure 10. Annual capture history of wild (white bars), hatchery reared (grey bars), and unknown origin (cross-hatched bars) Pallid Sturgeon collected in Segment 13 of the Missouri River from 2003-2014. Figure is designed to compare overall Pallid Sturgeon captures from year to year and is biased by variable effort among years. Figure includes all Pallid captures including non-random and wild samples.

Shovelnose X Pallid Sturgeon Hybrids

We captured twelve genetically confirmed Shovelnose Sturgeon x Pallid Sturgeon hybrids in Segment 13 during 2014. Genetic testing indicated that one stocked 1992 year class sturgeon captured in 2014 was a hybrid. Two Shovelnose Sturgeon x Pallid Sturgeon hybrids were captured using standard gill nets, five with standard trotlines, one with standard trammel nets, two with wild trotlines, and two with 76 mm bar mesh gill nets. Shovelnose Sturgeon x Pallid Sturgeon hybrids captured in 2014 ranged in length from 586 to 908 mm FL, and weights ranged from 700 to 2,900 g. Since 2003, 90 sturgeon identified as Shovelnose Sturgeon x Pallid Sturgeon hybrids have been captured in Segment 13. At least six of these fish have been captured multiple times.

Targeted Native River Species

Shovelnose Sturgeon

A total of 4,123 Shovelnose Sturgeon were collected in Segment 13 during 2014, of which 3,710 were collected with standard gears. Gill nets accounted for 43% of the Shovelnose Sturgeon collected in standard gears. The quality and above size class (> 380 mm FL) continued to dominate the CPUE of Shovelnose Sturgeon for all gear types. Quality and above size Shovelnose Sturgeon CPUE (7.25 fish/net night ±1.91) with gill nets in 2014 appeared similar to the long term average (Figure 11). Trammel net CPUE (4.12 fish/100 m) for quality and above size in 2014 was the highest on record. Trammel net CPUE for Shovelnose Sturgeon has varied greatly between years (Figure 12). For otter trawls (both seasons), quality and above size class CPUE (1.34 fish/100 m ±0.39) in 2014 was the highest on record (Figure 13). Otter trawls also frequently captured sub-stock size Shovelnose Sturgeon. For the 2014 fish community season otter trawl CPUE for sub-stock (0-149 mm) was the third highest on record and was similar to 2009 and 2013. During the sturgeon season, 2014 CPUE of sub-stock (150-249 mm) was 60% lower than in 2013. Trotline CPUE for quality and above size Shovelnose Sturgeon in 2014 was more than three times as great as 2013, and was similar to 2010 and 2011 (Figure 14).

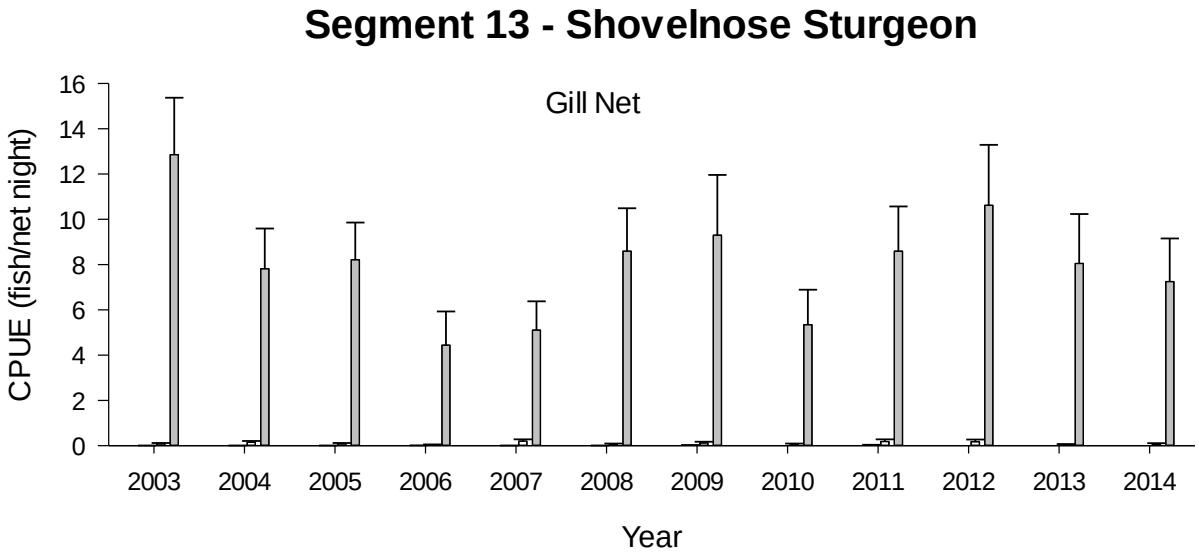

Figure 11. Mean annual catch per unit effort (±2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using gill nets in Segment 13 of the Missouri River from 2003-2014.

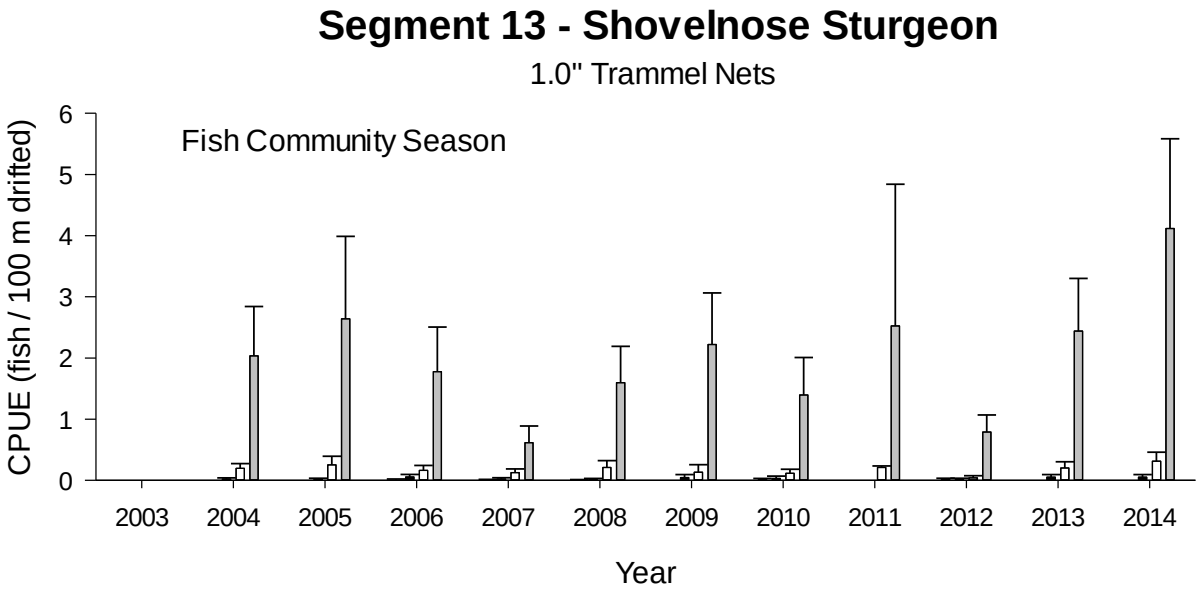

Figure 12. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using 1.0” trammel nets in Segment 13 of the Missouri River from 2003-2014.

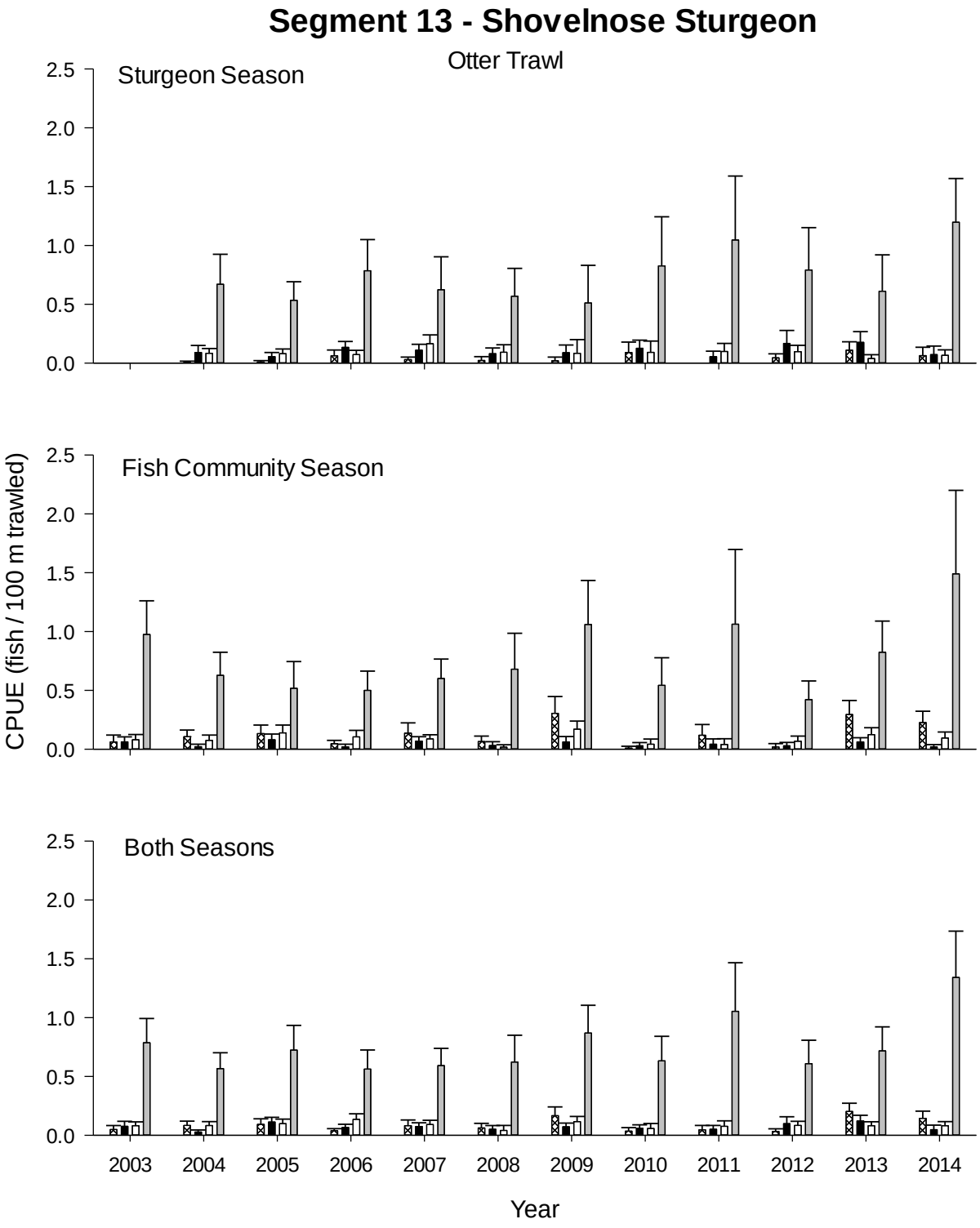

Figure 13. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using otter trawls in Segment 13 of the Missouri River from 2003-2014.

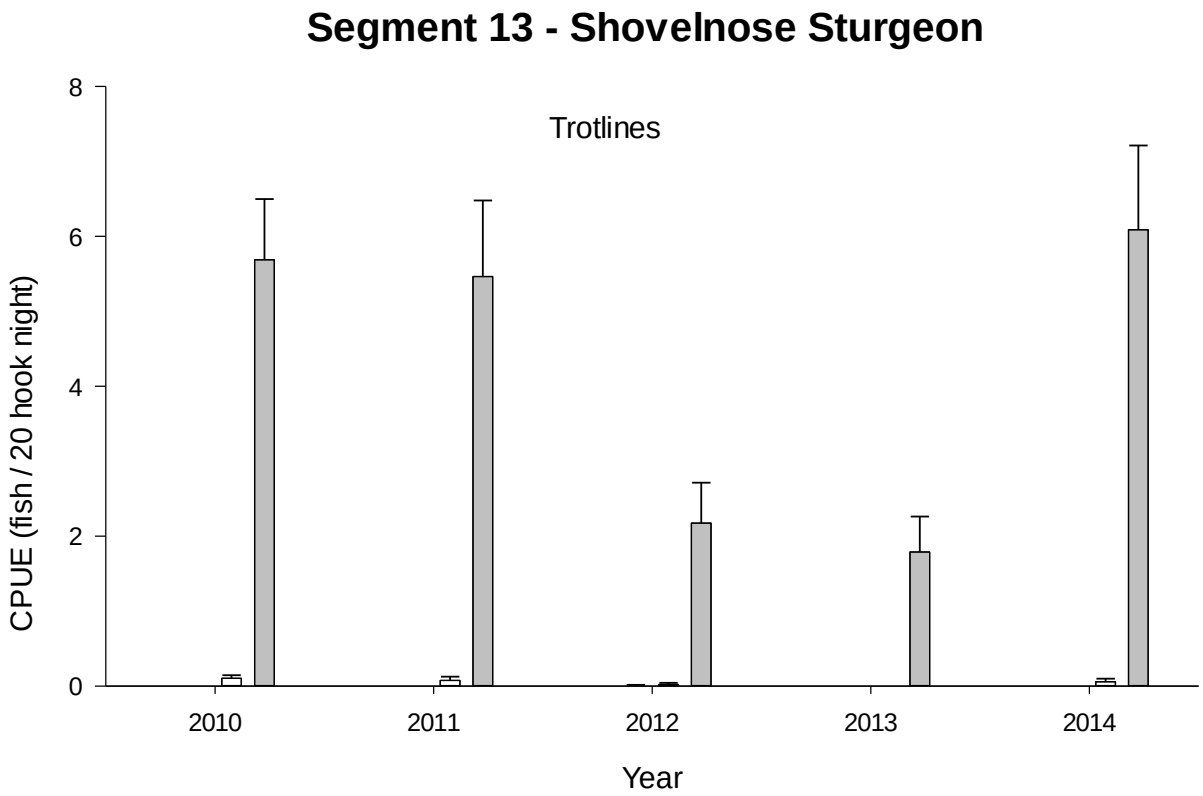

Figure 14. Mean annual catch per unit effort (±2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using trotlines in Segment 13 of the Missouri River from 2010-2014.

Habitat Use

Forty-six sub-stock size (0-149 mm FL) Shovelnose Sturgeon were captured in otter trawls during the fish community season and nine were captured during the sturgeon season. No other gears captured sub-stock (0-149 mm) Shovelnose Sturgeon. Sub-stock size (0-149 mm FL) Shovelnose Sturgeon were captured from the ISB, CHXO and SCCL macrohabitats (Table 9) Samples where sub-stock size (0-149 mm FL) shovelnose sturgeon were captured had mean depths of 3.4 m and mean bottom current velocities of 0.63 m/s . Fourteen sub-stock size (150-249 mm FL) were captured during the sturgeon season and ten were captured during the fish community season. Otter trawls captured most (75%) sub-stock size (150-249 mm FL) shovelnose sturgeon, but trammel nets did capture some. Sub-stock size (150-249 mm) Shovelnose Sturgeon were captured from ISB, CHXO and SCCL macrohabitats (Table 10). Samples where sub-stock size (150-249 mm FL) shovelnose sturgeon were captured had mean depths of 3.3 m and mean bottom current velocities of 0.61 m/s Trammel nets captured the most (*n* = 34) stock size Shovelnose Sturgeon. Overall, stock size Shovelnose Sturgeon were captured in ISB macrohabitat in greater proportion than it was sampled. Stock size Shovelnose Sturgeon were also captured in CHXO and OSB habitats, but were not captured from SCCL macrohabitat (Table 11). Quality size and greater Shovelnose Sturgeon were captured with all gear types but were most frequently captured with gill nets. Quality size and greater Shovelnose Sturgeon were captured in all macrohabitats sample except for SCCS and TRMS (Table 12). For all size classes combined, gill nets captured the most shovelnose sturgeon and

the majority were captured at ISB macrohabitats where the greatest amount of effort was expended (Table 13).

Shovelnose Sturgeon ranged in size from 11-763 mm FL, but most (90%) Shovelnose Sturgeon were between 400 and 650 mm (Figure 15). The proportion of sub-stock size Shovelnose Sturgeon during the 2014 fish community season appeared to be slightly less than in 2012 or 213, but was similar to other years (Figure 16). As in past years, the preferred size category dominated the catch. The PSD for Shovelnose Sturgeon in 2014 appeared similar to most other years. Mean W_r of Shovelnose Sturgeon collected in Segment 13 during 2014 was between 87-95 for all size classes. Since 2012, we have observed a general increase in W_r for preferred and memorable/trophy size Shovelnose Sturgeon. Stock and quality size Shovelnose Sturgeon have not followed the same trend, but W_r values for these size classes were still above 90. In general, W_r for shovelnose in Segment 13 decline slightly with increasing length (Figure 17).

Table 9. Total number of sub-stock size (0-149 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]														
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	9	N-E	33	0	N-E	N-E	N-E	0	56	0	11	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	46	N-E	7	0	N-E	N-E	N-E	0	93	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 10. Total number of sub-stock size (150-249 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	14	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	6	N-E	17	0	N-E	N-E	N-E	0	83	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	4	N-E	25	0	N-E	N-E	N-E	0	50	0	25	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 11. Total number of stock size (250-379 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	15	N-E	13	0	N-E	N-E	N-E	0	47	40	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	10	N-E	10	0	N-E	N-E	N-E	0	90	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	34	N-E	3	0	N-E	N-E	N-E	0	97	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	14	N-E	7	0	N-E	N-E	N-E	0	93	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	11	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 12. Total number of quality size and greater (≥380 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	1595	N-E	36	0	N-E	N-E	N-E	0	45	17	1	0	0	1	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	158	N-E	24	0	N-E	N-E	N-E	0	76	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	414	N-E	9	0	N-E	N-E	N-E	0	91	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	233	N-E	6	0	N-E	N-E	N-E	0	88	0	0	0	0	7	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	1108	N-E	25	0	N-E	N-E	N-E	0	52	17	0	0	0	5	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

Table 13. Total number of Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]														
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	1610	N-E	36	0	N-E	N-E	N-E	N-E	45	17	1	0	0	1	0	0
		N-E	26	0	N-E	N-E	N-E	N-E	55	15	2	0	0	2	0	0
Otter Trawl	191	N-E	22	0	N-E	N-E	N-E	N-E	77	0	1	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	N-E	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	454	N-E	9	0	N-E	N-E	N-E	0	91	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	297	N-E	6	0	N-E	N-E	N-E	0	88	0	0	0	0	0	5	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	0	2	0
Both Seasons																
Trot Lines	1119	N-E	25	0	N-E	N-E	N-E	0	53	17	0	0	0	5	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

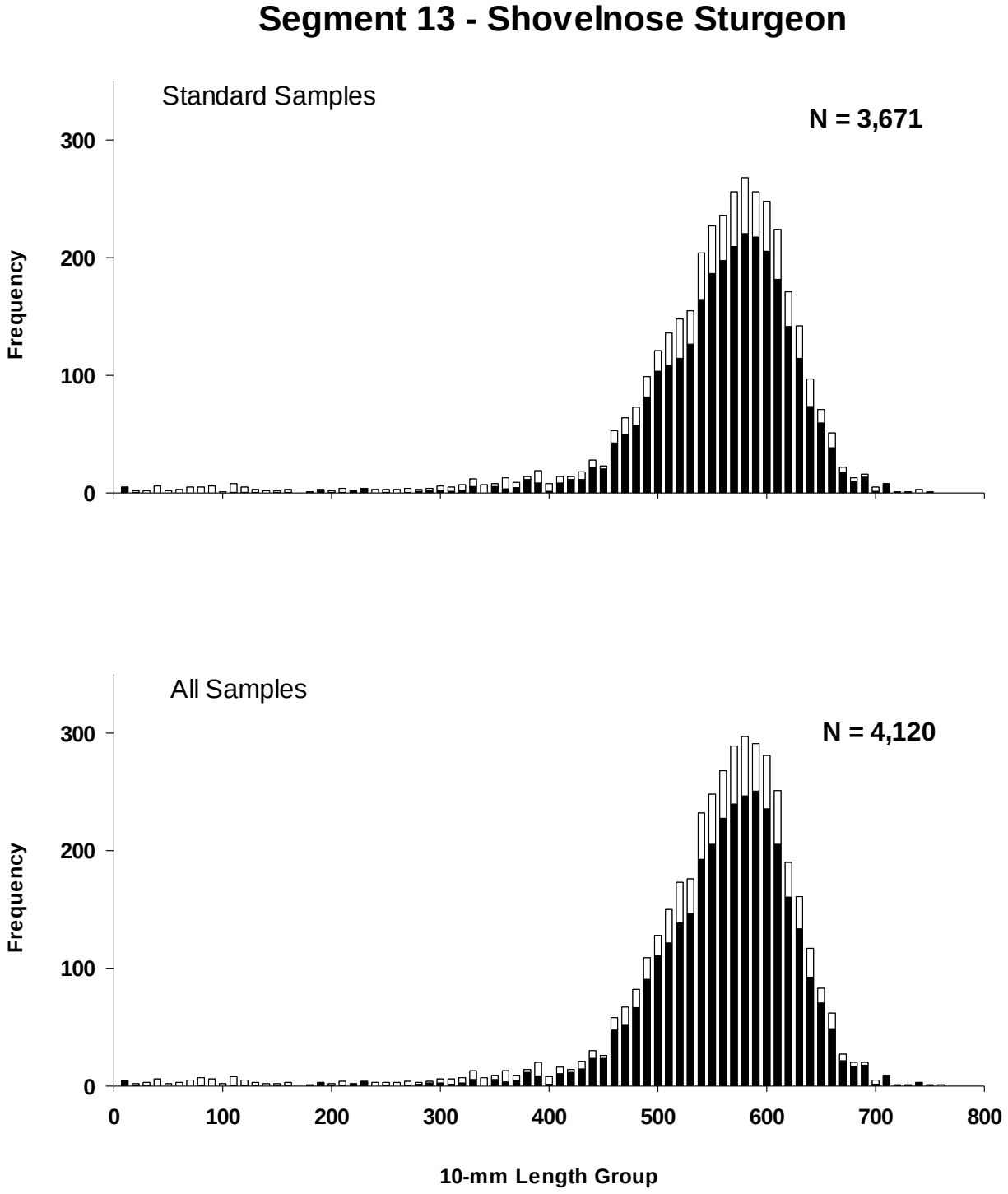

Figure 15. Length frequency of Shovelnose Sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

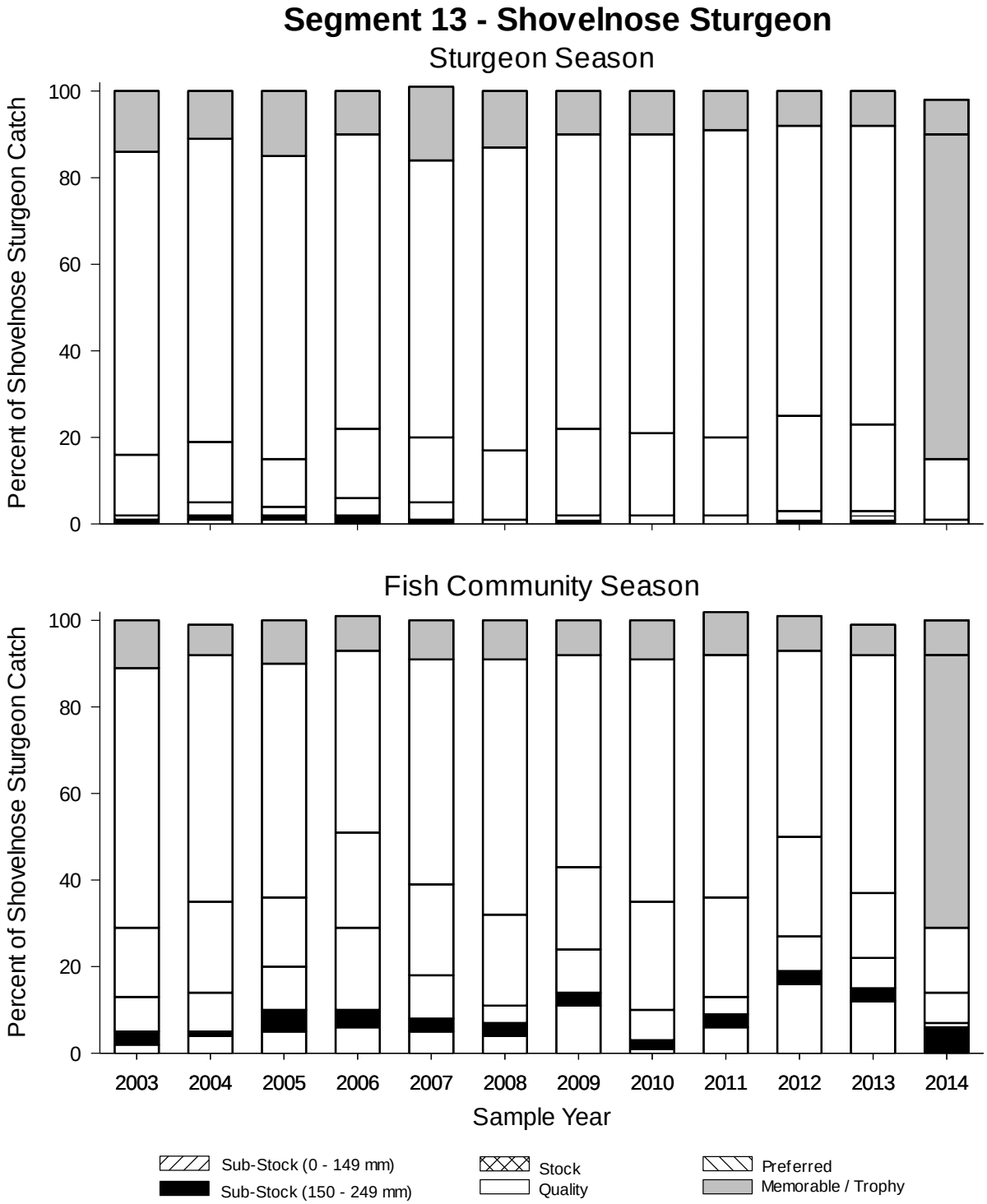

Figure 16. Incremental proportional size distribution (PSD) for all Shovelnose Sturgeon captured with all gear by length category from 2003 to 2014 in Segment 13 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

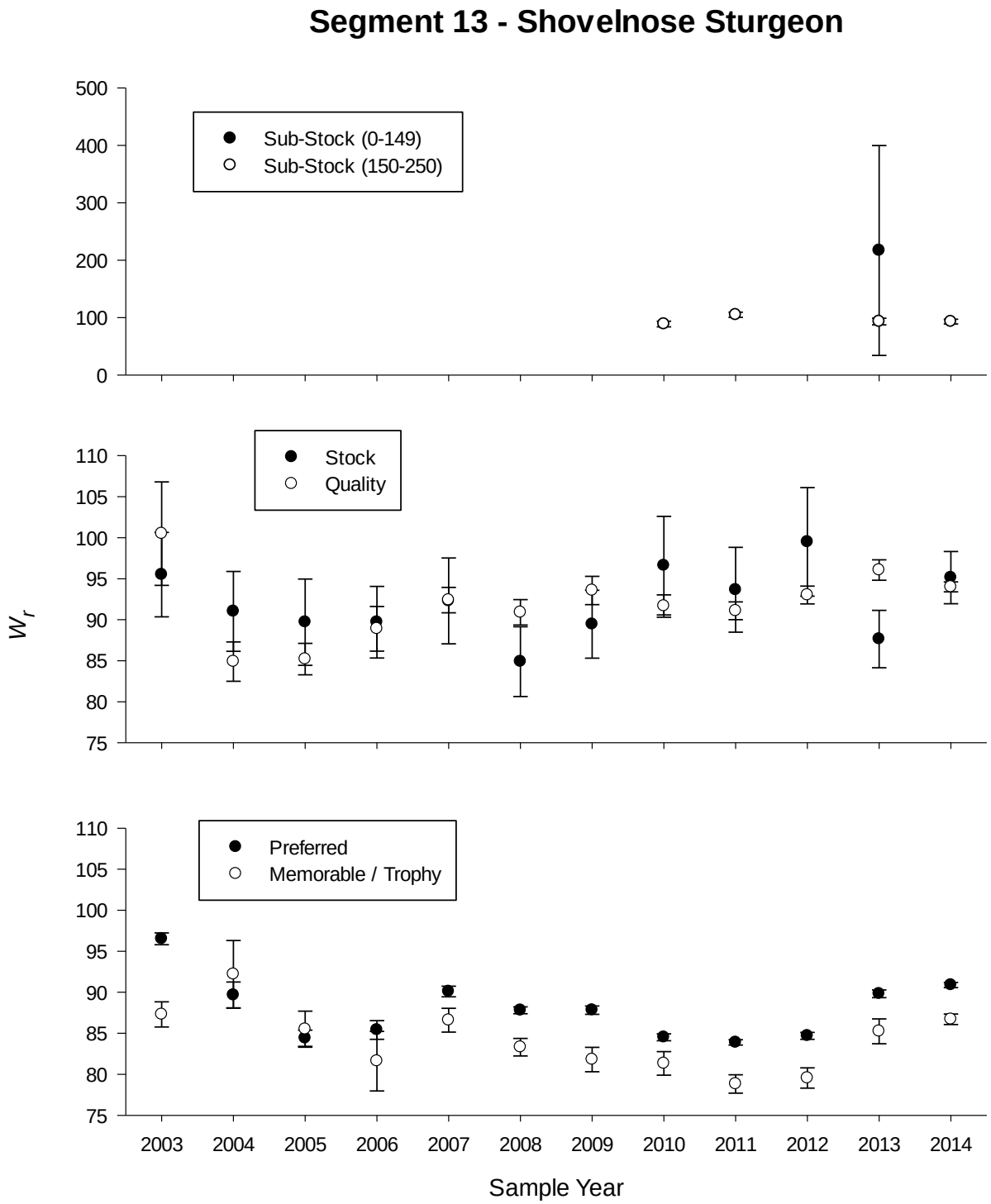

Figure 17. Relative weight (*Wr*) for all Shovelnose Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2014 in Segment 13 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

We captured a total of 225 Sturgeon Chub. Sturgeon Chub otter trawl CPUE during 2014 sturgeon season was the highest on record at 0.95fish/100 m, but decreased to 0.13 fish/100m during the fish community. A single trawl sample containing 70 individual Sturgeon Chub made up 31% of the total catch for 2014. For both seasons combined Sturgeon Chub CPUE during 2014 was the highest on record (Figure 18). There appears to have been a general increase in Sturgeon Chub CPUE since 2012. Sturgeon Chub ranged in length from 27-90 mm TL. During the sturgeon season 59% of Sturgeon Chub captured were greater than 50 mm TL; conversely during the fish community season only 12% of Sturgeon Chub captured were greater than 50 mm TL (Figure 19).

Sturgeon Chub were captured in ISB, CHXO, and SCCL macrohabitats, with 92% of captures coming from ISB macrohabitats. Bottom current velocities where Sturgeon Chub were captured averaged 0.6 m/s (range 0.3-1.0 m/s, N=35). Depths where Sturgeon Chub were captured averaged 2.7 m and ranged from 0.8– 5.1 m.

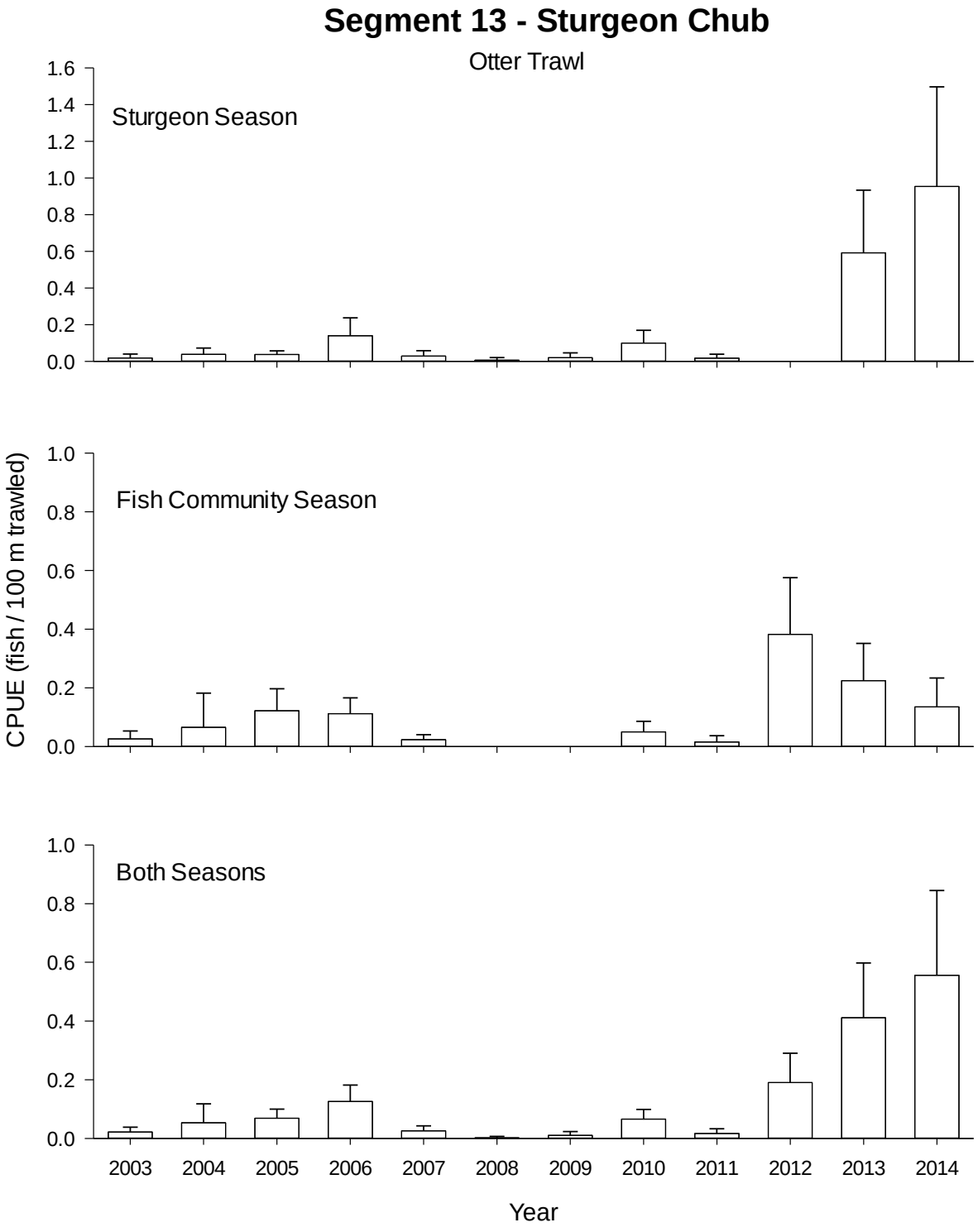

Figure 18. Mean annual catch per unit effort (± 2 SE) of Sturgeon Chub using otter trawls in Segment 13 of the Missouri River from 2003-2014.

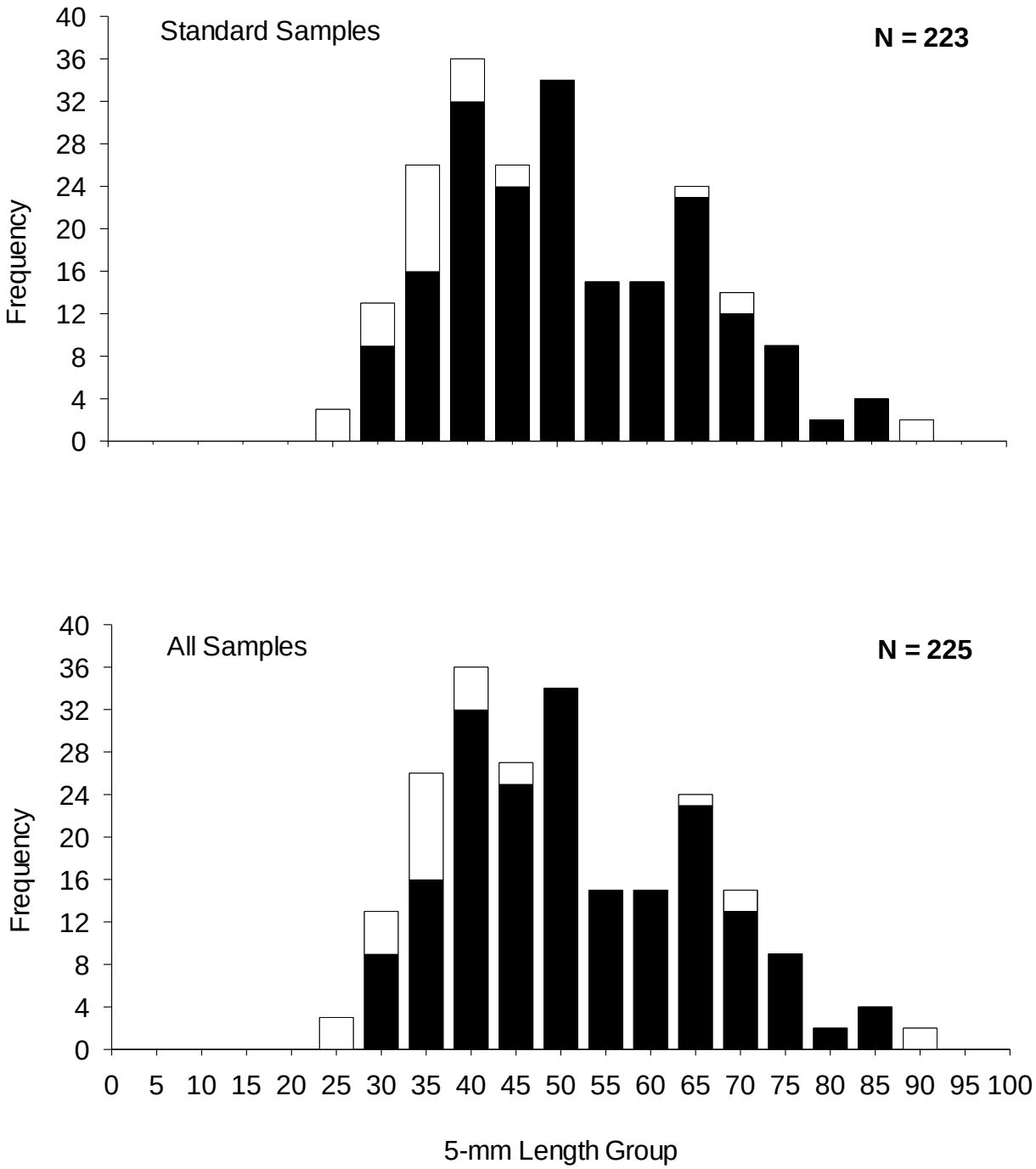

Figure 19. Length frequency of Sturgeon Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Sicklefin Chub

A total of 448 Sicklefin Chub were collected. Sicklefin Chub CPUE for otter trawl during the 2014 sturgeon season was the highest on record (1.36 fish/100 m) and was similar during fish community season (1.47 fish/100 m). Overall, 2014 Sicklefin Chub CPUE for both seasons was the second highest on record (1.41 fish/100 m) (Figure 20). Sicklefin Chub ranged in size from 22 to 101 mm TL. Seventy-six percent of Sicklefin Chub collected during fish community season were less than 50 mm TL (Figure 21). There appears to have been a general increase in Sicklefin Chub CPUE since 2012.

Eighty-three percent of Sicklefin Chub were captured in ISB macrohabitats and none were captured in OSB habitats. Bottom velocities where Sicklefin Chub were collected averaged 0.6 ± 0.2 m/s and ranged from 0.1 – 1.0 m/s. Depths where Sicklefin Chub were collected averaged 3.5 ±1.3 m and ranged from 0.8– 7.3 m.

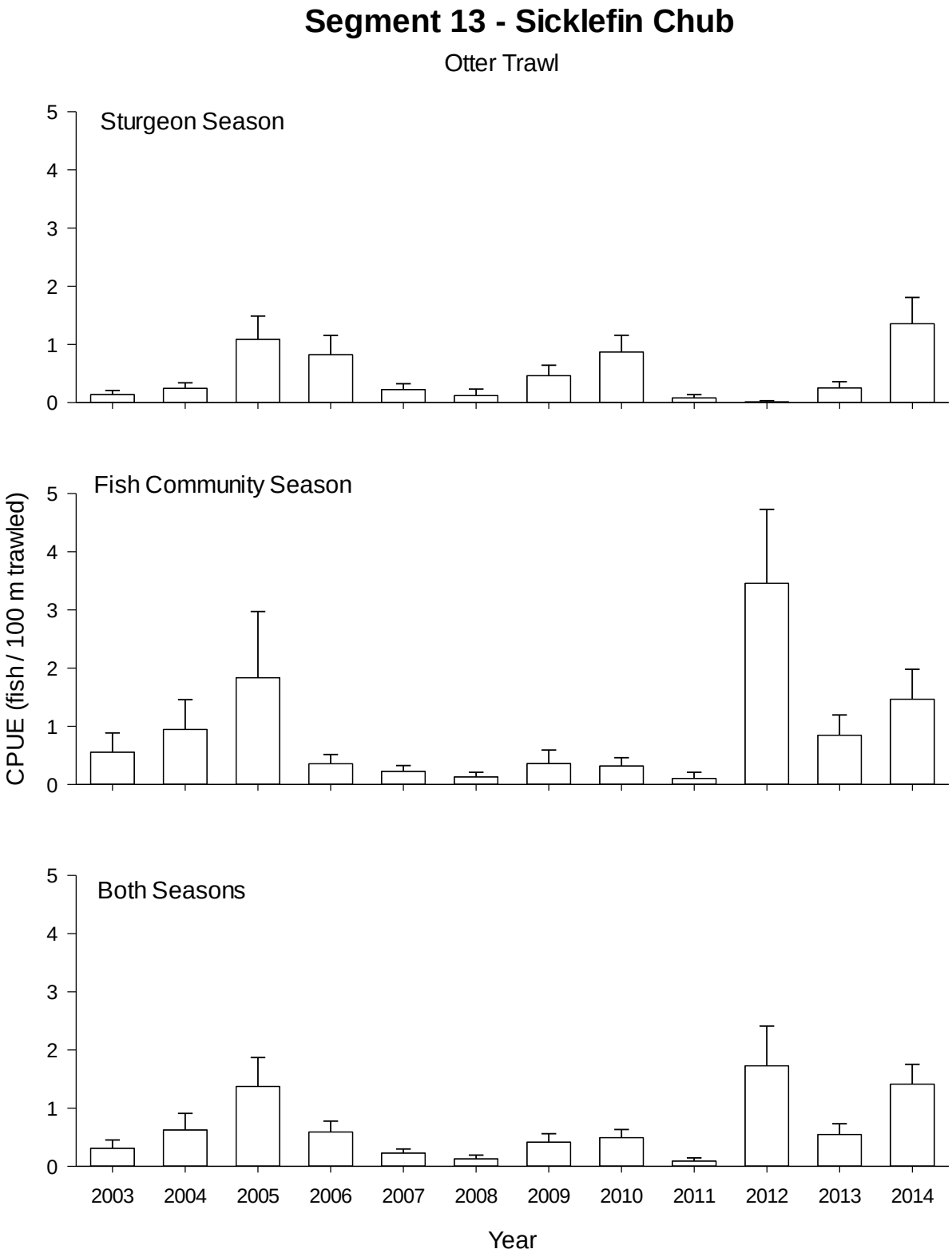

Figure 20. Mean annual catch per unit effort (± 2 SE) of Sicklefin Chub using otter trawls in Segment 13 of the Missouri River from 2003-2014.

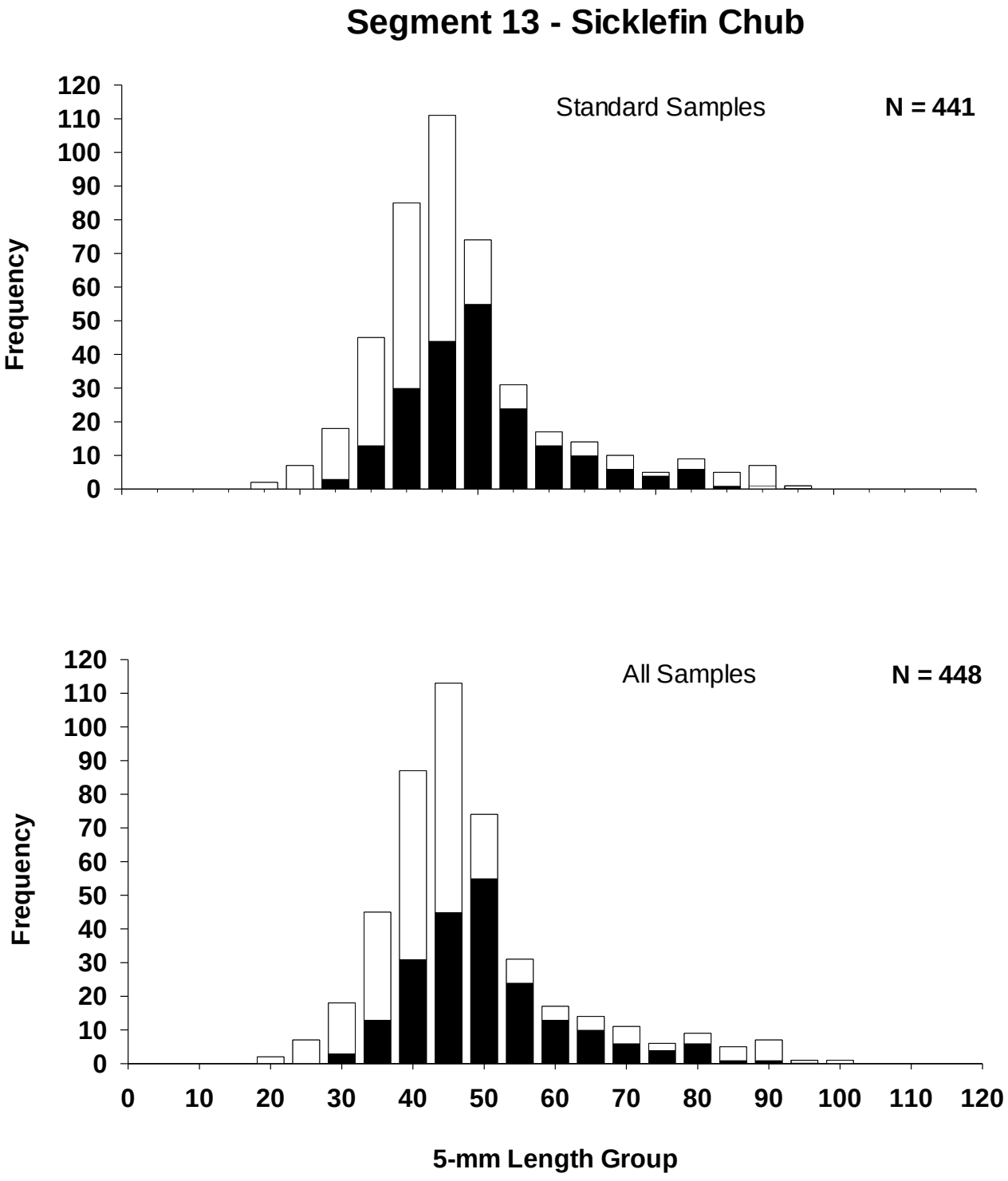

Figure 21. Length frequency of Sicklefin Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Shoal Chub

We captured 612 Shoal Chubs during the 2014 sample season. Ninety-nine percent of Shoal Chub were captured with standard OT16 otter trawls. Shoal Chub CPUE (3.0 fish/100 m) for otter trawls during the 2014 sturgeon season was more than twice as great as any other year; however CPUE decreased to 0.6 fish/100 m during the fish community season (Figure 22). For both seasons combined 2014 CPUE was the highest on record. There appears to have been a general increase in Shoal Chub CPUE since 2012. Shoal Chub lengths ranged from 21 to 92 mm TL, with 69% > 40 mm suggesting, age-1 and older size comprised the majority of the sample; however many age-0 size Shoal Chub were also collected (Figure 23, Herman et al. 2008b). Seventy-eight percent of Shoal Chub were captured in ISB macrohabitats. Bottom velocities where Shoal Chub were collected averaged 0.5 m/s ±0.2 SD and ranged from 0.0 – 1.2 m/s. Depths where Shoal Chub were collected averaged 2.7 m ±1 and ranged from 0.1 – 6.5 m.

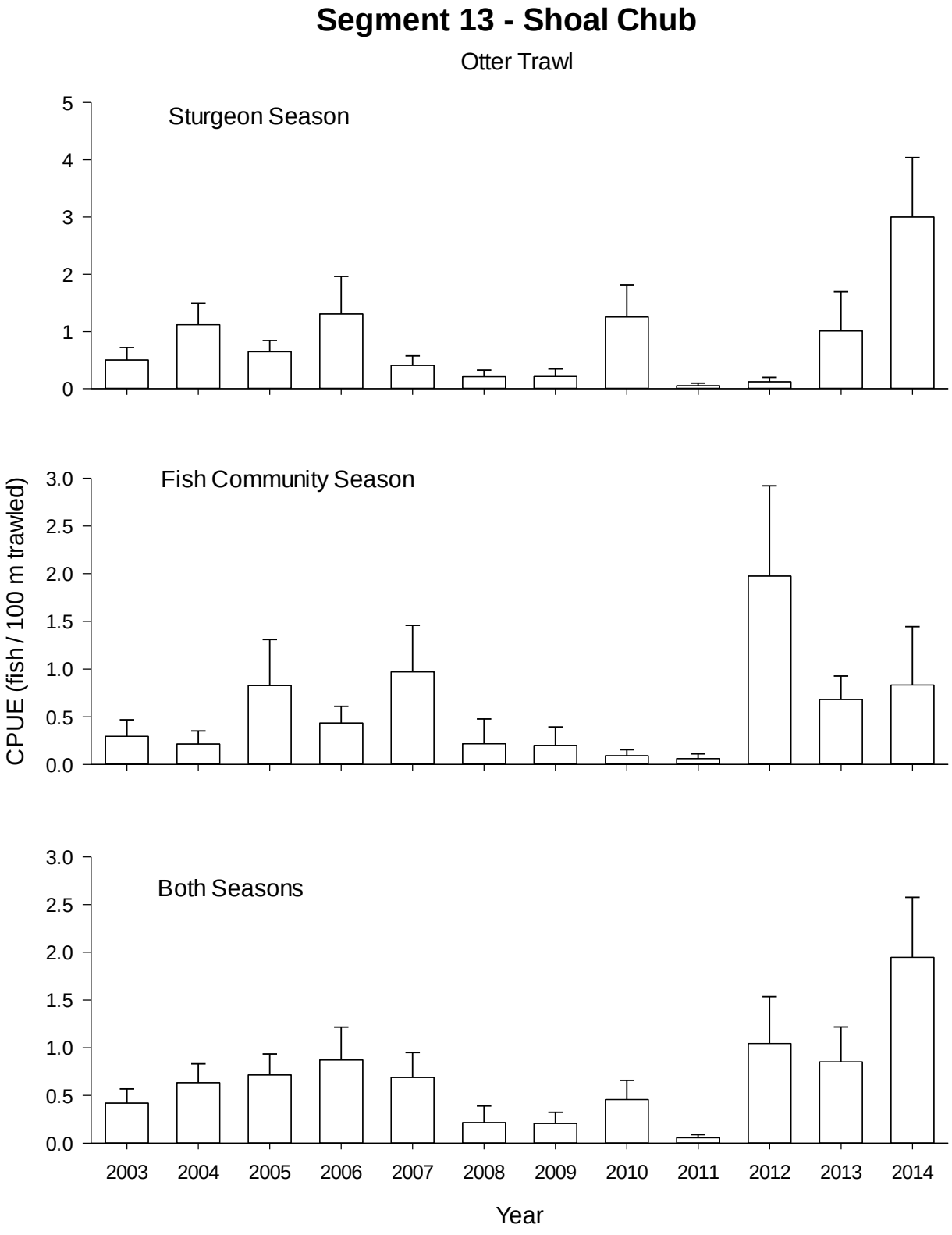

Figure 22. Mean annual catch per unit effort (± 2 SE) of Shoal Chub using otter trawls in Segment 13 of the Missouri River from 2003-2014.

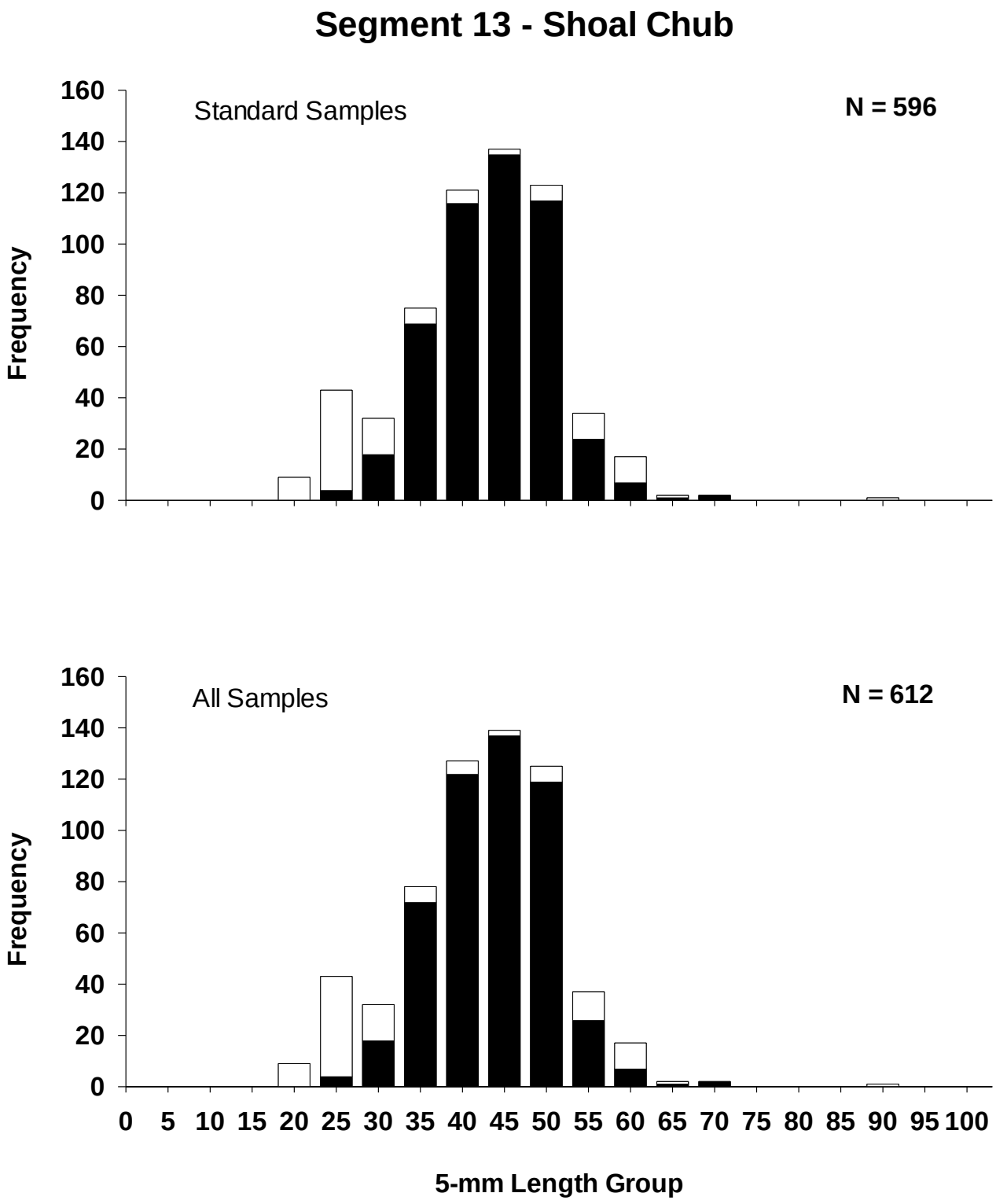

Figure 23. Length frequency of Shoal Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Sand Shiner

We captured 19 Sand Shiner in 2014. All Sand Shiner were captured in mini-fyke nets. Sand Shiner CPUE in mini-fyke nets was the highest since 2006, but was only 0.2 fish/net night (Figure 24). Sand Shiner lengths ranged from 30 to 47 mm (Figure 25). Most Sand Shiner were age-0 size (i.e. ≤35 mm), but age-1 size were also present (Dattilo et al. 2008a).

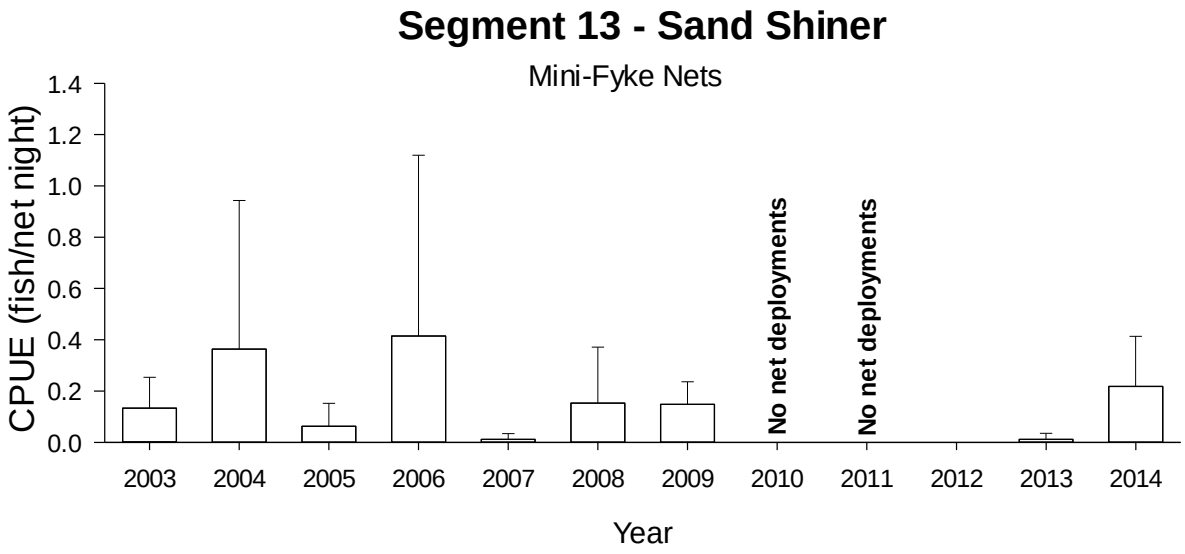

Figure 24. Mean annual catch per unit effort (± 2 SE) of Sand Shiner with mini-fyke nets in Segment 13 of the Missouri River during fish community season 2003-2014.

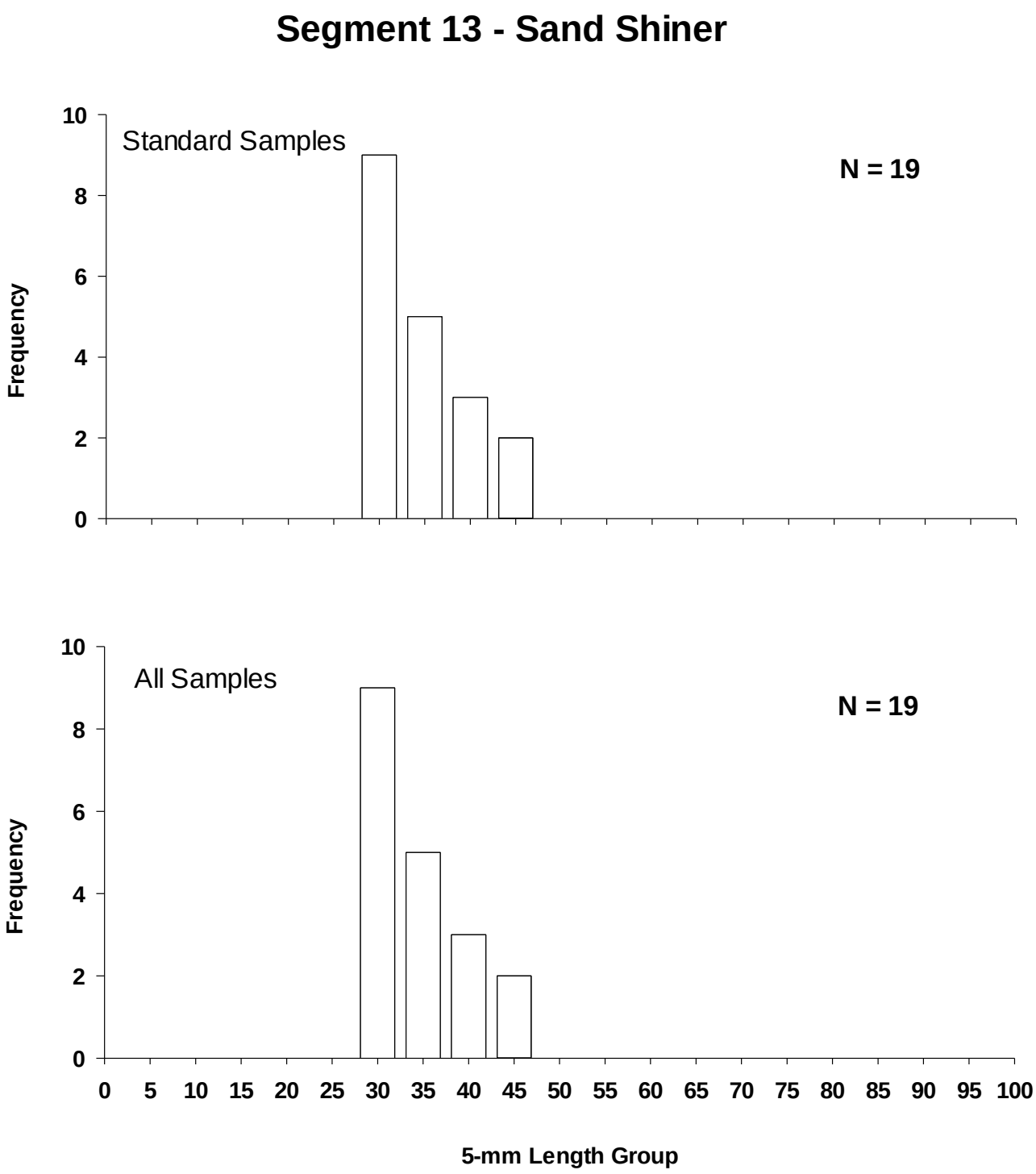

Figure 25. Length frequency of Sand Shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Hybognathus spp.

We captured 55 *Hybognathus* spp. in 2014. Ninety-eight percent of *Hybognathus* spp. were captured with mini-fyke nets. Catch-per-unit-effort for *Hybognathus* spp. with mini-fyke nets (0.6 fish/net night) in 2014 was the greatest since 2008(Figure 26). Lengths ranged from 25 to 46 mm. Similar to 2013, most fish were of a size consistent with age-0. This stands in contrast to 2012 when most *Hybognathus* spp. were greater than 50 mm, a size consistent with age-1 and older (Figure 27, Dattilo et al. 2008b). All *Hybognathus* that we were able to identify to species were identified to Plains Minnow.

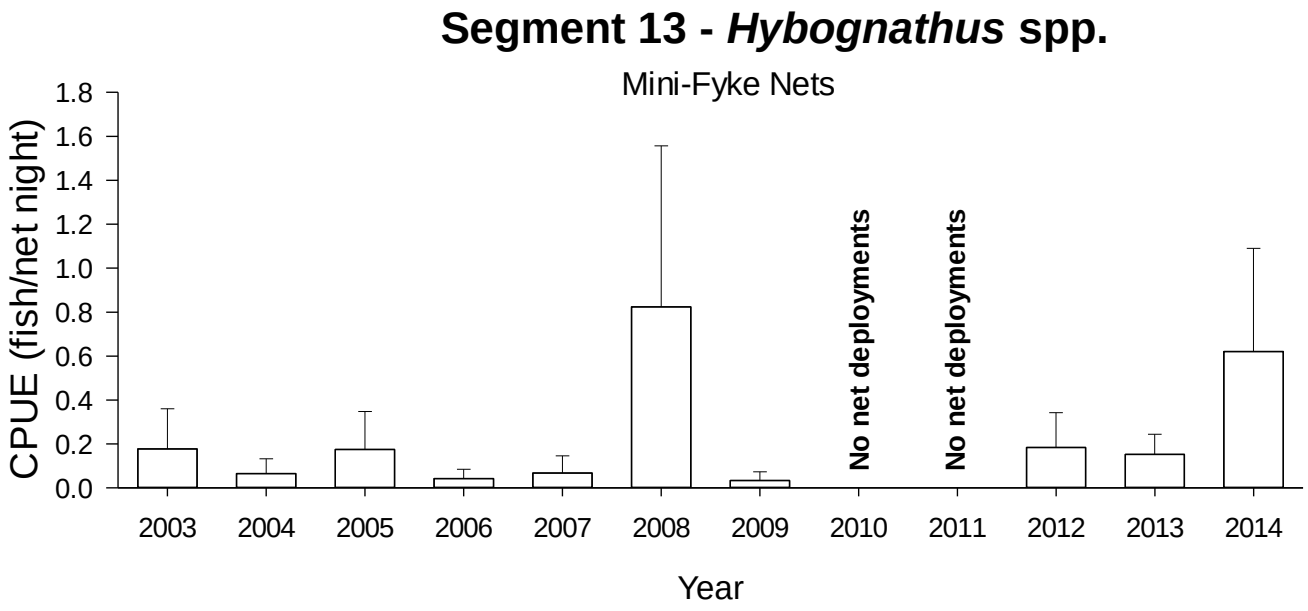

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 13 of the Missouri River during fish community season 2003-2014.

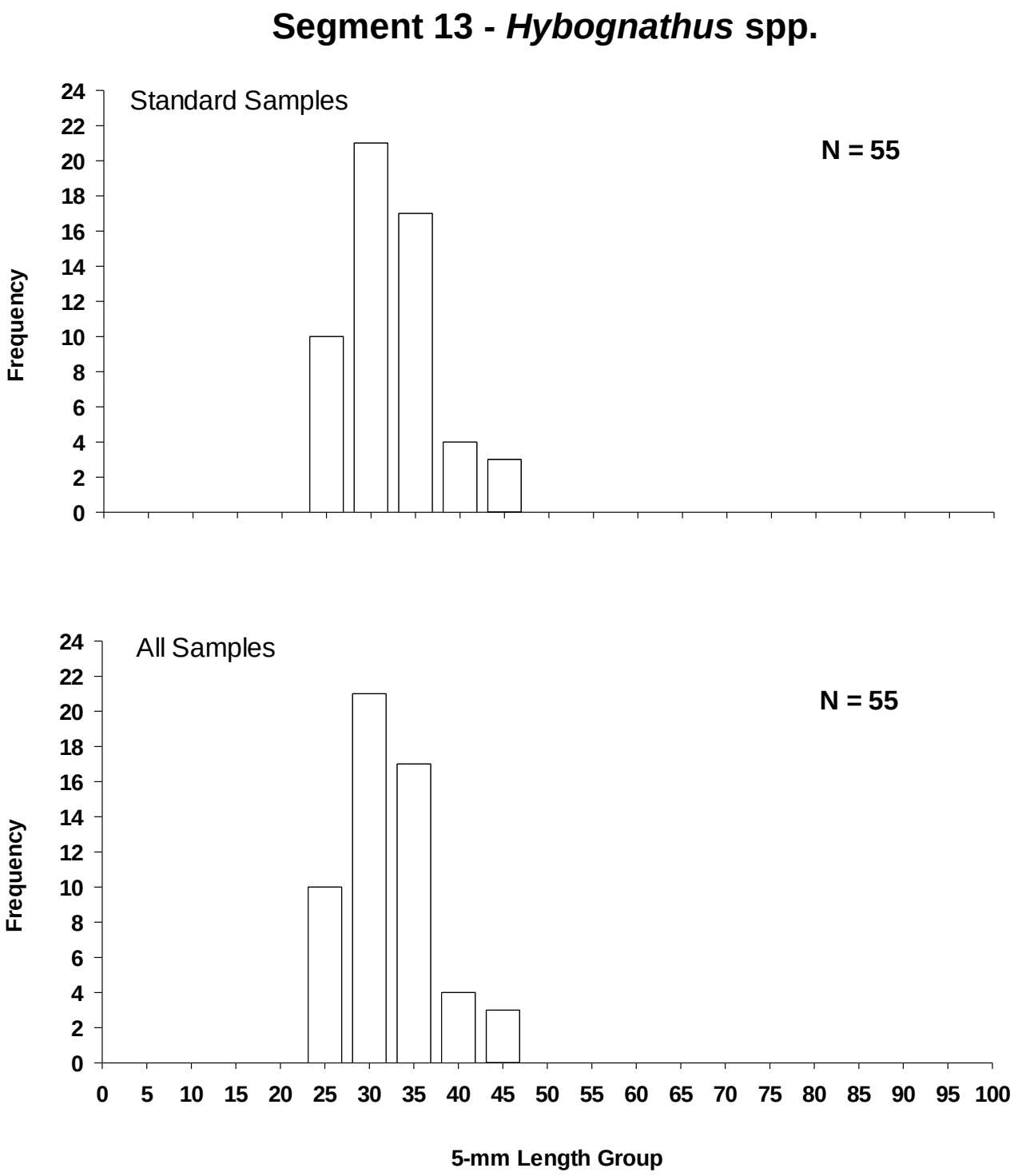

Figure 27. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Blue Sucker

We captured 160 total Blue Sucker in 2014 (146 in standard gears and 14 in wild gears). Blue Sucker CPUE for gill nets during 2014 was the highest on record and appeared to be more than three times greater than the long term average CPUE (Figure 28). Trammel net CPUE (0.39 fish/100 m) in 2014 appeared to be lower than 2013, but was similar to 2012 (Figure 29). Catch-per-unit-effort in otter trawls for both seasons during 2014 was more than twice as great as any other year (Figure 30). In general, Blue Sucker CPUE in all gears appears to have increased since 2011. Blue Sucker were most commonly collected with gill nets, and were most often captured in ISB macrohabitats, but were also found in CHXO, OSB and SCCL (Table 14). Blue Suckers ranged in length from 391 to 875 mm TL (Figure 31). In 2014, similar to most years, small Blue Sucker (≤400 mm TL) were rare, comprising less than one percent of the sample; However in 2012, small juvenile Blue Sucker (≤ 400 mm TL) comprised 22% of the sample. Length distribution of Blue Sucker in 2014 suggests no age-0 fish were captured, and most fish were likely greater than age-3 (LaBay 2008). Three peaks were noted in length frequency distribution.

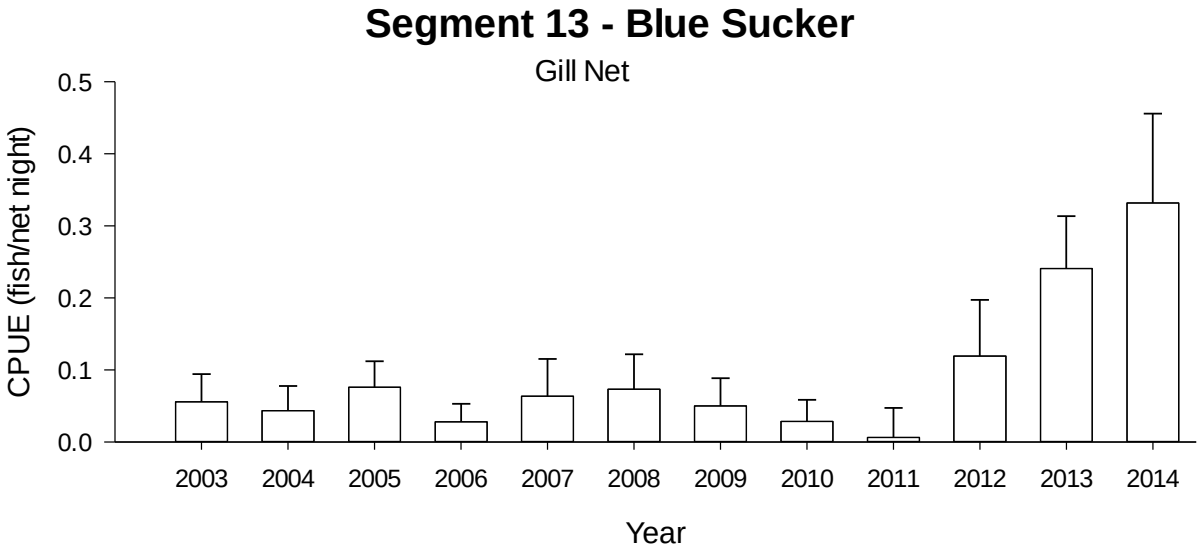

Figure 28. Mean annual catch per unit effort (± 2 SE) of Blue Suckers using gill nets in Segment 13 of the Missouri River from 2003-2014.

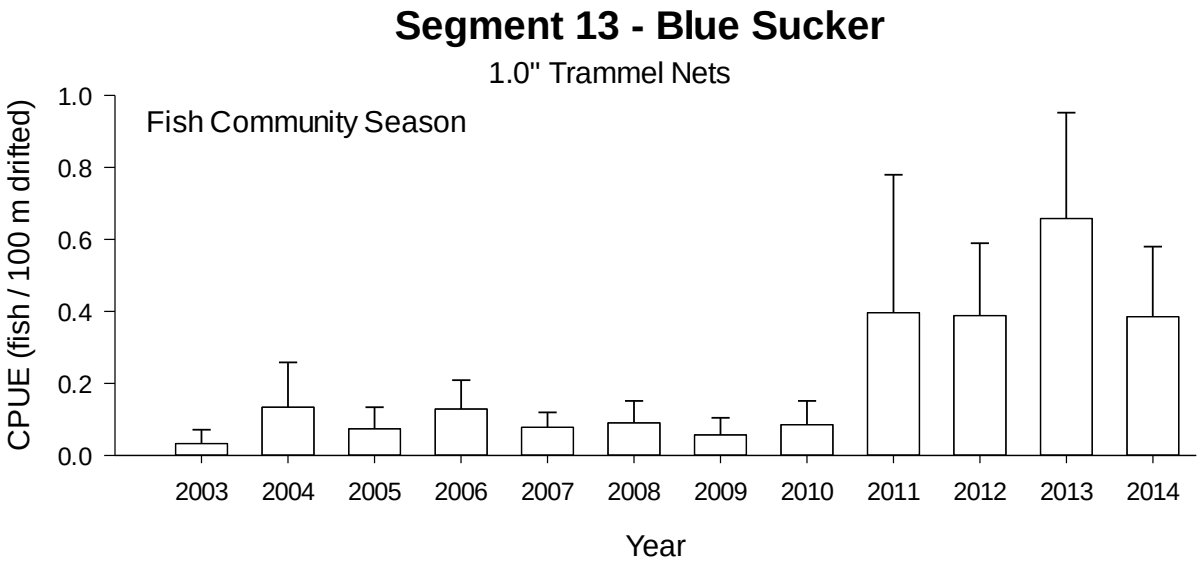

Figure 29. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using 1.0" trammel nets in Segment 13 of the Missouri River from 2003-2014.

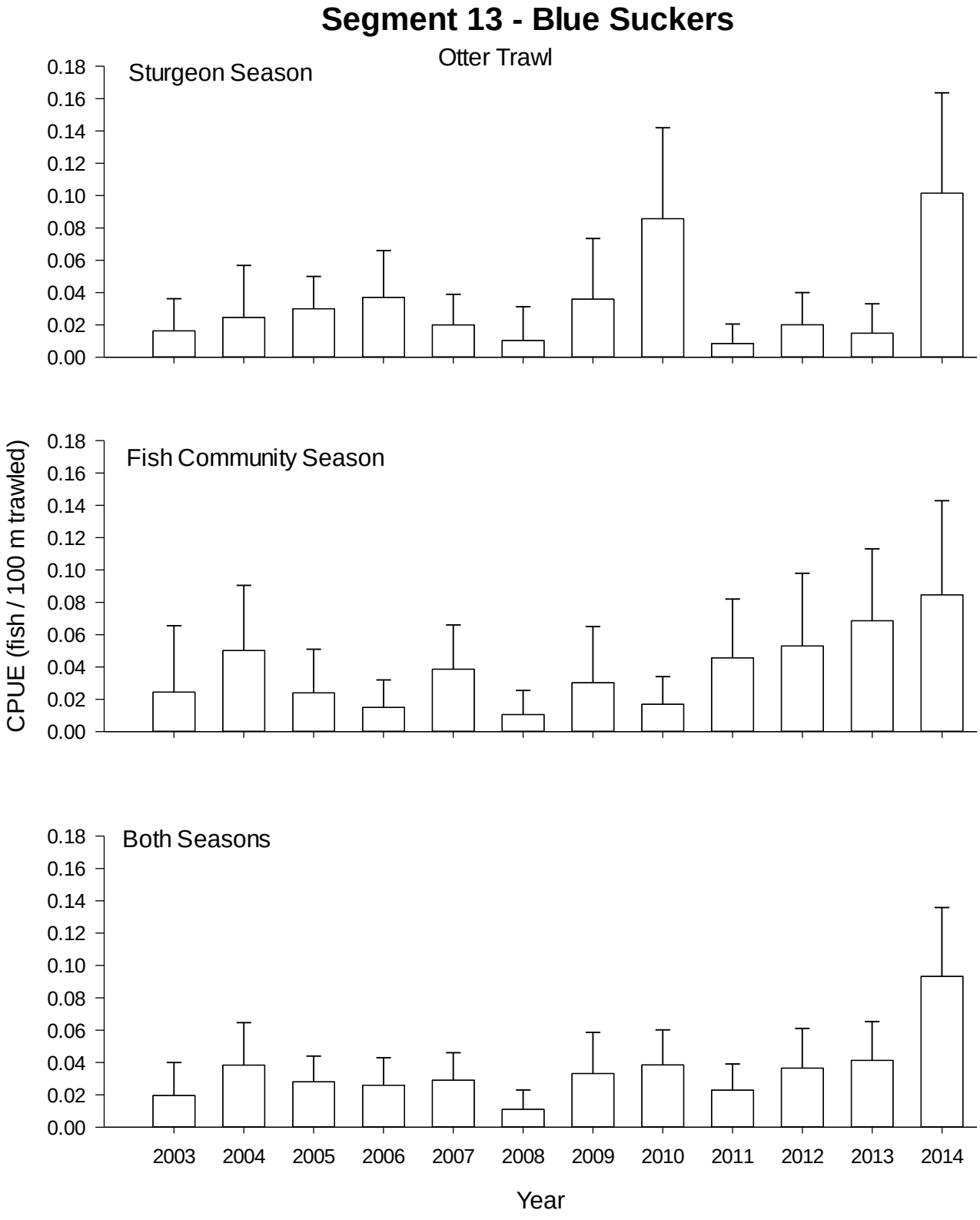

Figure 30. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using otter trawls in Segment 13 of the Missouri River from 2003-2014.

Table 14. Total number of Blue Suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	73	N-E	25	0	N-E	N-E	N-E	0	63	10	3	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	16	N-E	6	0	N-E	N-E	N-E	0	88	0	6	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	45	N-E	16	0	N-E	N-E	N-E	0	84	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	11	N-E	0	0	N-E	N-E	N-E	0	91	0	9	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

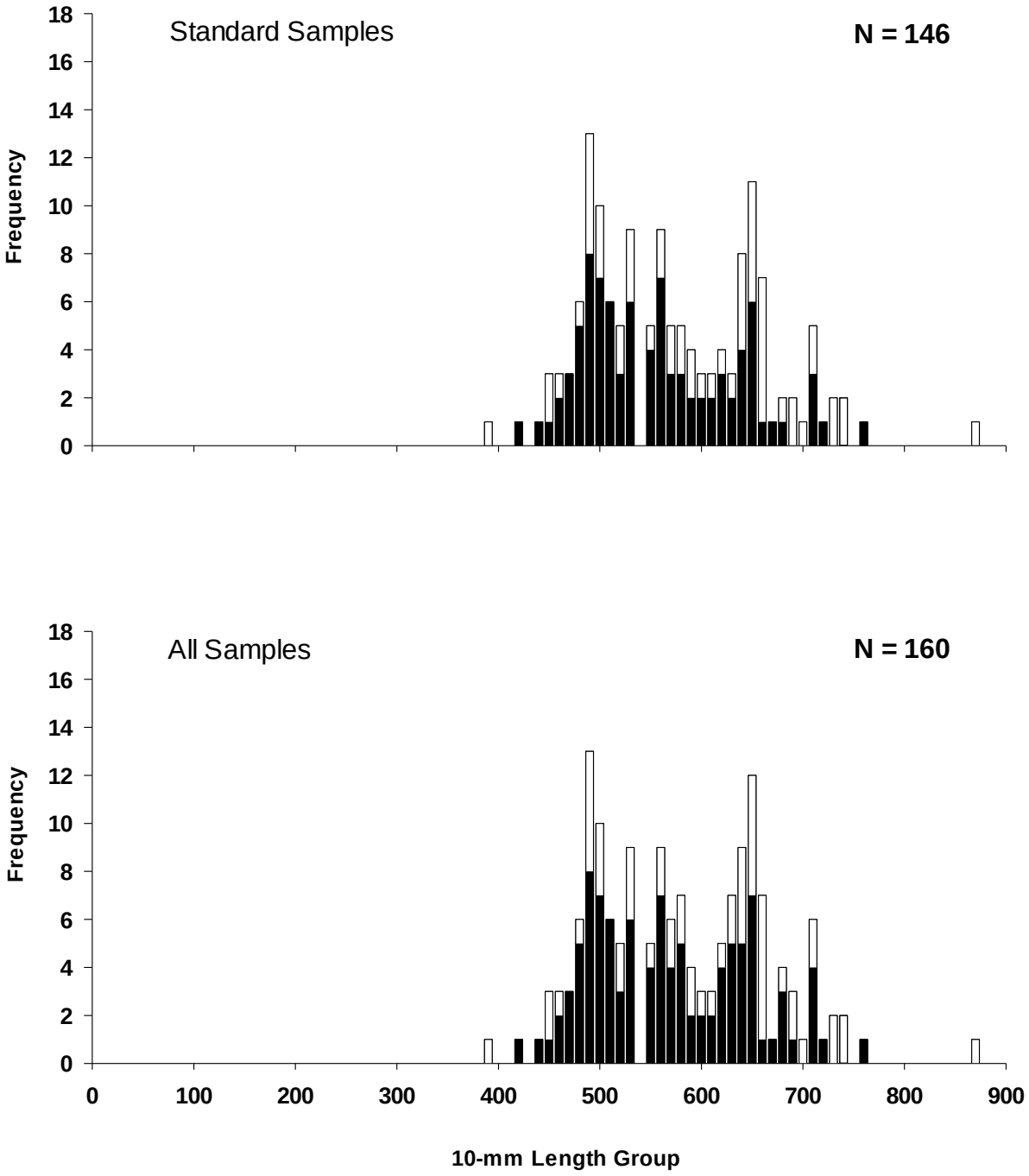

Figure 31. Length frequency of Blue Sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Sauger

A total of 22 Sauger were captured in 2014. Most sauger (77%) were captured in gill nets. Gill net CPUE for Sauger in 2014 appeared to be similar to 2013 and 2012 (Figure 32). Similar to other years, Sauger CPUE in trammel nets was low with only 0.007 fish captured for 100 m drifted (Figure 33). Likewise, Sauger CPUE in otter trawls was only 0.008 fish per 100 m trawled (Figure 34). Despite only 15% of gill net effort expended in OSB macrohabitats, 29% of Sauger were captured in OSB. Conversely, despite 26% of the gill net effort in CHXO macrohabitat, only 12% of Sauger were captured here (Table 15). Sauger ranged in size from 24 to 606 mm TL. The majority (77%) of Sauger were between 300 and 500 mm TL. Three Sauger were <100 mm, a size consistent with age-0 (Figure 35; Dattilo 2008c).

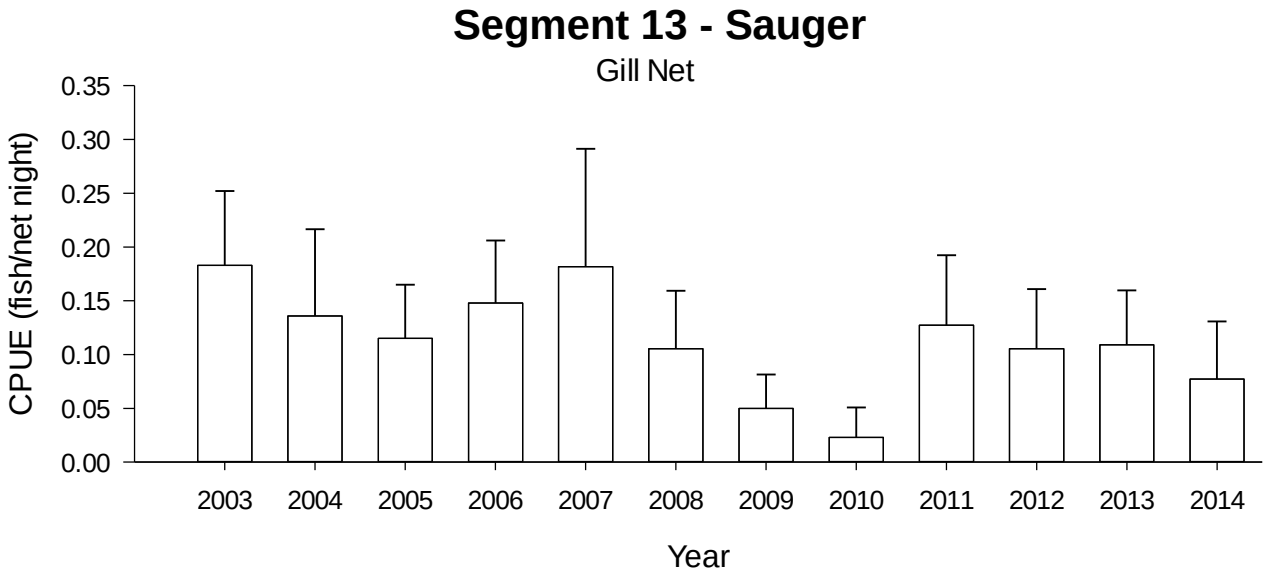

Figure 32. Mean annual catch per unit effort (± 2 SE) of Sauger using gill nets in Segment 13 of the Missouri River from 2003-2014.

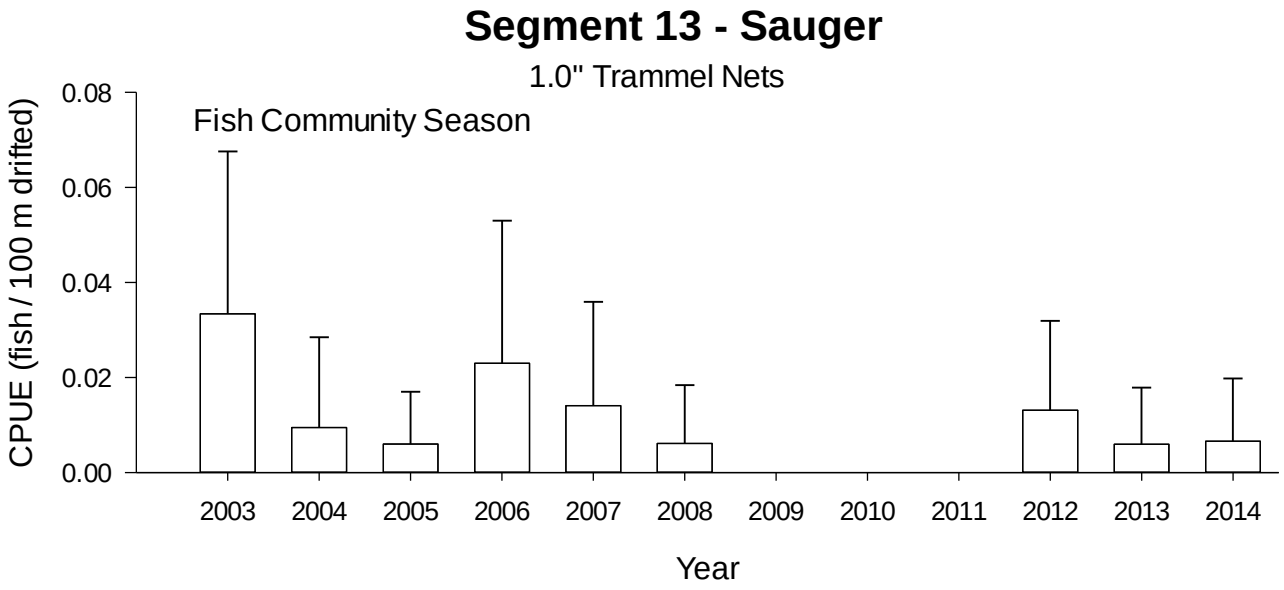

Figure 33. Mean annual catch per unit effort (± 2 SE) of Sauger using 1.0” trammel nets in Segment 13 of the Missouri River from 2003-2014.

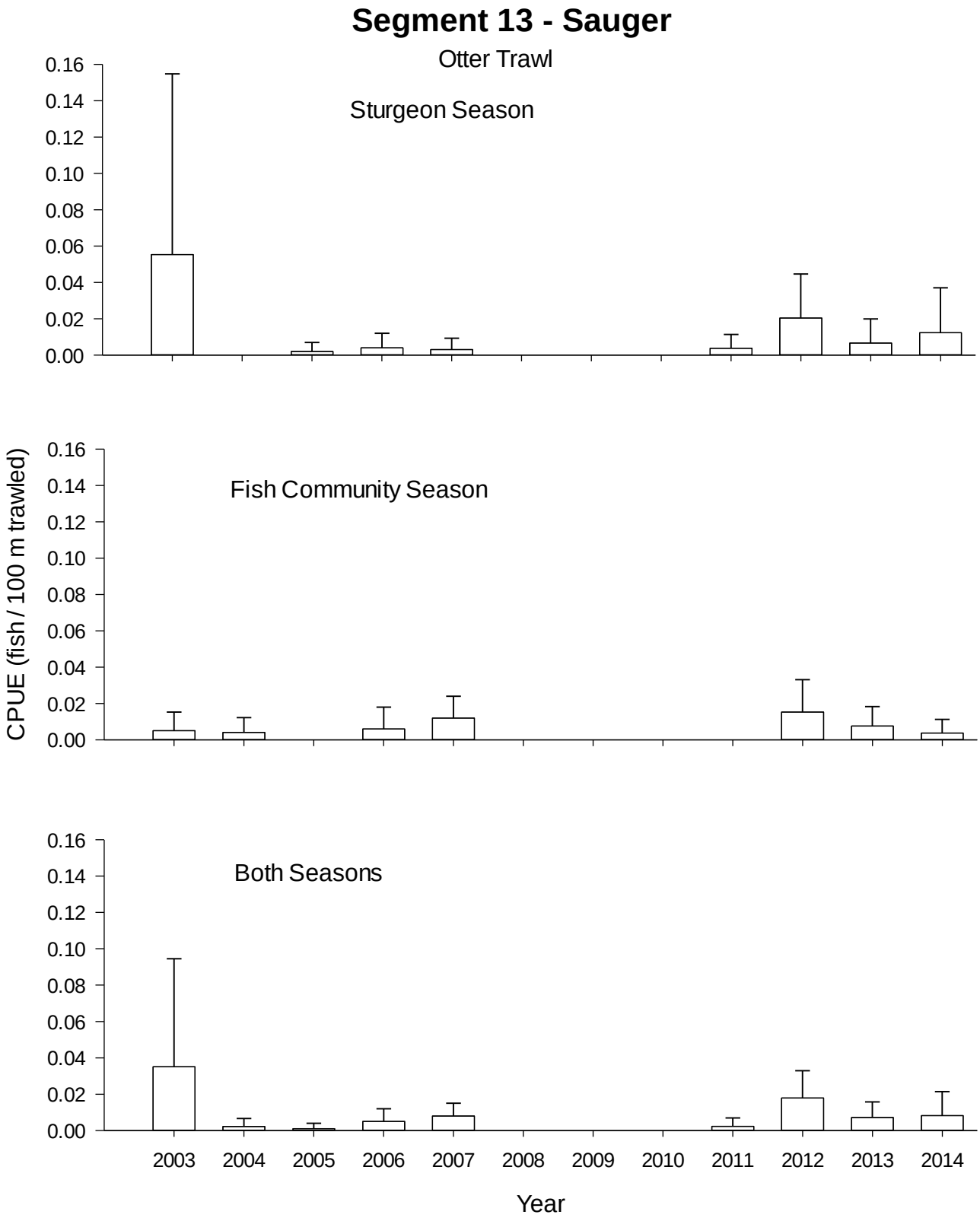

Figure 34. Mean annual catch per unit effort (± 2 SE) of Sauger using otter trawls in Segment 13 of the Missouri River from 2003-2014.

Table 15. Total number of Sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 13 of the Missouri River during 2014. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	17	N-E	12	0	N-E	N-E	N-E	0	59	29	0	0	0	0	0	0
		N-E	26	0	N-E	N-E	N-E	0	55	15	2	0	0	2	0	0
Otter Trawl	2	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	2	4	0	0	0	0	0
Fish Community Season																
1.0” Trammel Net	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
Mini-Fyke Net	1	N-E	100	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	18	0	N-E	N-E	N-E	0	53	18	1	3	0	0	6	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	0	0	100	0	0	0	0	0
		N-E	13	0	N-E	N-E	N-E	0	81	0	4	0	0	2	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	57	14	2	0	0	2	0	0

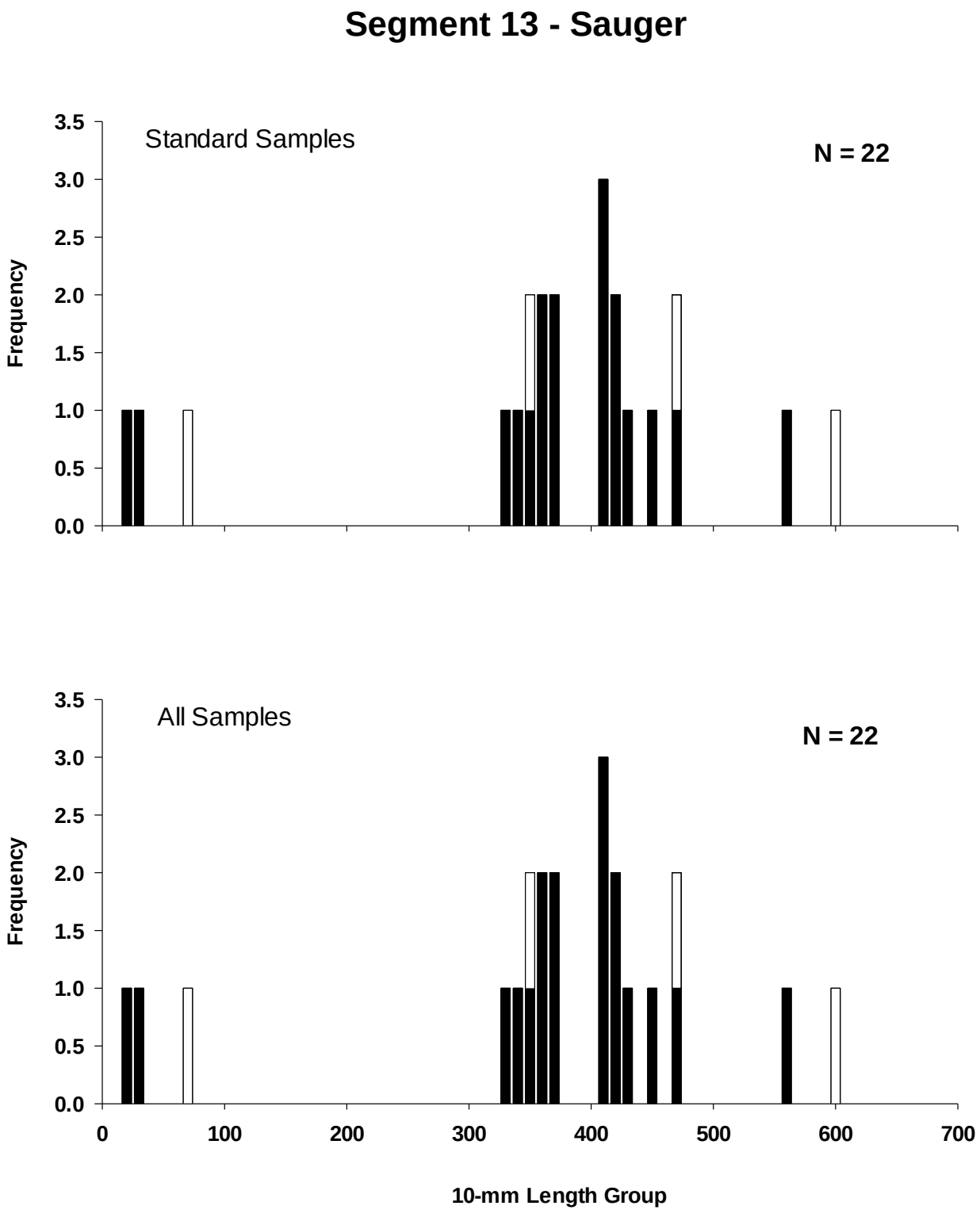

Figure 35. Length frequency of Sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 13 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Missouri River Fish Community

We captured 12,532 total fish representing 56 unique species. Shovelnose Sturgeon (*n* =4,123), Freshwater Drum (*n* = 1,125) and Silver Carp (*n* = 1,118) were the most abundant species. In 2014, most Silver Carp were age-0 size fish captured in mini-fyke nets. Only 65 individual Gizzard Shad were captured in 2014, compared to 1,105 in 2013. Channel catfish (*n* = 1,025) and Blue Catfish (*n* = 545) were commonly captured. Channel Catfish ranged in length from 19 to 736 mm TL, and 43% were < 70 mm. Blue Catfish ranged in length from 29 to 900 mm TL, and 6% were < 70 mm TL. Other notable species included: Lake Sturgeon (*n* = 7), Paddlefish (*n* = 4), and American Eel (*n*= 1). Non-native carp continue to be relatively common in Segment 13, with 1,118 Silver Carp, 119 Common Carp, 49 Grass Carp and 7 Bighead Carp captured in 2014. Our standard gears likely underestimate true abundances of Asian carp because we frequently observe more fish jumping out of the water than we collect in fishing gears. In 2014, 98% of Silver Carp captured were age-0 size (i.e. less than 200 mm). Additionally, 155 Asian carp too small to identify to species were captured. This contrasts with 2012 and 2013 when very few age-0 Asian carp were captured.

Pallid Sturgeon stocking locations for RPMA 4 are listed in Appendix D. Pallid Sturgeon stocking locations for Segment 13, numbers stocked and stocking date can be found in Appendix E. Hatchery names and locations are listed in Appendix G. An alphabetic list of Missouri River fishes with CPUE by gear type is found in Appendix H. Appendix I provides a comprehensive list of Segment 13 bends sampled between 2003 and 2013.

Discussion

Recovery of Pallid Sturgeon depends on establishment of a self-sustaining, naturally recruiting population (Dryer and Sandvol 1993; US Fish and Wildlife Service 2003). While the Pallid Sturgeon population in lower Missouri River (LMOR) has been supplemented through stocking, natural recruitment appears to be very limited. It is widely believed that recruitment to age-1 represents a population bottleneck for Pallid Sturgeon. In 2014, Habitat Assessment Monitoring Program field crews using small mesh trawls captured three genetically confirmed Pallid Sturgeon larvae in LMOR. These represented the first genetically confirmed larvae from the LMOR and indicated that successful reproduction had occurred and larvae survived for at least a short time; but the scarcity of these larvae, relative to the extensive sampling effort, suggested that reproduction and survival rates were low. The Pallid Sturgeon Population Assessment Project (PSPAP) has never captured genetically confirmed Pallid Sturgeon larvae from the LMOR since monitoring began in 2003. The scarcity of Pallid Sturgeon larvae, coupled with the experimental design of PSPAP (i.e. not designed for capturing larval sturgeon), makes it unlikely that PSPAP would currently be able to detect Pallid Sturgeon larvae. Even if PSPAP was able to detect Pallid Sturgeon larvae, it is unlikely that sample sizes would be sufficient to make linkages between Pallid Sturgeon reproduction/recruitment and habitat function or environmental processes; thereby limiting our capacity to make informed management recommendations. However, PSAP currently collects data on juvenile/adult Pallid Sturgeon and all life stages of other target species. These data may be important for understanding environmental processes and habitat function on LMOR.

All four presumed wild Pallid Sturgeon were adult size >740 mm suggesting no recent recruitment in Segment 13. The 2014 Pallid Sturgeon catch in Segment 13 was dominated by young hatchery fish, in particular the increase in 2011 year class fish, suggested that this year class had fully recruited to our gears. The decline in proportion of 2002 year class in Segment 13 may have been an artifact of this year class migrating through the system. The proportion of 2002 year class in Segment 13 peaked shortly after the 2011 flood (in 2012 and 2013) and declined in 2014. Greater Pallid Sturgeon captures in upper portions of Segment 13 in 2014 may have been an artifact of proximity to recent stocking locations. The demonstrated propensity for some Pallid Sturgeon to remain near stocking locations should be accounted for when determining stocking locations. Condition factors for all size classes of Pallid Sturgeon were above 0.90, which suggested adequate prey for the current population; however K_n decreased slightly for larger size classes. Interestingly, K_n for quality and preferred size Pallid Sturgeon was greater in Segment 14 when compared with Segment 13. This could be due to greater abundances of prey (e.g. Sicklefin and Shoal chubs) found in Segment 14 (Herman and Wrasse 2015). The year-to-year variability in trotline CPUE suggested that confounding variables, such as prey abundance and interspecific competition, may affect CPUE, and thereby limit this gear's effectiveness as a population monitoring tool.

Relatively high catch rates of age-0 size Shovelnose Sturgeon suggested that 2014 was a good reproduction year for Shovelnose Sturgeon, similar to 2009 and 2013. Evidence of annual reproduction and recruitment coupled with relatively stable catch rates of adult size Shovelnose Sturgeon again pointed to a fairly stable population. Understanding how reproduction/recruitment of Shovelnose Sturgeon differs from Pallid Sturgeon in LMOR will be

important for Missouri River Recovery. Caution should be exercised when interpreting trammel net CPUE. Catch rates for this gear have varied greatly between years, and apparent high Shovelnose Sturgeon catch rates from trammel nets in 2014 could be an artifact of favorable sampling conditions at the time. Guy et al. 2009 indicated that low river discharge can increase trammel net catch rates. Improved W_r in larger size class Shovelnose Sturgeon since 2011 suggested that available prey may have increased since the 2011 flood.

Relative abundances of *Macrhybopsis* chub species remained high. After low catch rates from 2008-2011, we have noted relatively high catch rates from 2012-2014 for all three chub species. The abundance of both age-0 chubs and adult chubs indicated the population in Segment 13 is currently reproducing and recruiting well. The exact mechanism behind improved chub populations in Segment 13 is not fully understood; however we believe that hydrologic conditions of the 2011 flood followed by low flows in 2012 and 2013 likely played a role. At this time we are unsure how stable the chub populations are over the long term. The increases we witnessed during the last three years may only be temporary.

Although catch rates of Sand Shiner and *Hybognathus* spp. increased in 2014, overall numbers remained relatively low. Interestingly, while catch rates of target species cyprinids appear to have increased in 2014, catch rates of a common generalist cyprinid (Red Shiner) declined.

Blue Sucker catch rates have increased since the 2011 flood, as the strong 2011 year class continues to recruit to our gears. The continued lack of age-0 size Blue Sucker in Segment 13 suggested that Blue Sucker are not reproducing in Segment 13.

Sauger, while annually present in our samples, are never abundant. The capture of age-0 size Sauger suggested that reproduction occurred within Segment 13.

Invasive Asian carp continued to be abundant in Segment 13. The high catches of age-0 size Silver Carp indicated they successfully spawned during 2014. While we do not fully understand how these invasive fish are affecting the Segment 13 ecosystem, we did note that the high abundance of age-0 Silver Carp in 2014 was correlated with declines in abundances of some native prey species (e.g. Gizzard Shad and Red Shiner).

Acknowledgments

Funding for this project was provided by the U.S. Army Corps of Engineers, Omaha District. This template report reflects several years of revision and contribution from four state and two federal agencies that make up the Pallid Sturgeon Population Assessment Team. Special thanks to the following Biologists and Technicians at the U.S. Fish and Wildlife Service, Columbia Fish and Wildlife Conservation Office for collecting and processing this fisheries data: Sarah Ettinger-Dietzel, Adam McDaniel, Brett Witte, Heather Garrison, Adam Prehoda, Jordan Fox, Jared Kneer, Kevin Drews, Russ Grigoriev and Skyler Schlick. Ron Budde provided critical administrative support to help this monitoring program run smoothly. Wyatt Doyle and Jeff Finley provided editing and program guidance. We thank the many volunteers that helped during the intensive brood stock period and throughout the sampling year. Thanks to Coral Huber with U.S. Army Corps of Engineers, Yankton, SD for designing, implementing and providing technical support for electronic data collection. Kyle Winders of the Missouri Department of Conservation Chillicothe Office maintained the database, performed data summaries and executed the general analysis for this report. We thank Tim Welker and George Williams for facilitating the important discussions required to promote the adaptive processes to improve this monitoring project and annual report.

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Appendices

Appendix A. Phylogenetic list of Missouri River fishes with corresponding letter codes used in the long-term Pallid Sturgeon and associated fish community sampling program. The phylogeny follows that used by the American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 5th edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
	CLASS CEPHALASPIDOMORPHI-LAMPREYS	
	ORDER PETROMYZONTIFORMES	
	Petromyzontidae – lampreys	
Ichthyomyzon castaneus	Chestnut Lamprey	CNLP
Ichthyomyzon fossor	Northern Brook Lamprey	NBLP
Ichthyomyzon unicuspis	Silver Lamprey	SVLP
Ichthyomyzon gagei	Southern Brook Lamprey	SBLR
Petromyzontidae	unidentified lamprey	ULY
Petromyzontidae larvae	unidentified larval lamprey	LVLP
	CLASS OSTEICHTHYES – BONY FISHES	
	ORDER ACIPENSERIFORMES	
	Acipenseridae – sturgeons	
Acipenser fulvescens	Lake Sturgeon	LKSG
Scaphirhynchus spp.	unidentified Scaphirhynchus	USG
Scaphirhynchus albus	**Pallid Sturgeon**	**PDSG***
Scaphirhynchus platorynchus	**Shovelnose Sturgeon**	**SNSG***
S. albus X S. platorynchus	pallid-shovelnose hybrid	SNPD
	Polyodontidae – Paddlefishes	
Polyodon spathula	Paddlefish	PDFH
	ORDER LEPISOSTEIFORMES	
	Lepisosteidae – gars	
Lepisosteus oculatus	Spotted Gar	STGR
Lepisosteus osseus	Longnose Gar	LNGR
Lepisosteus platostomus	Shortnose Gar	SNGR
	ORDER AMMIFORMES	
	Amiidae – bowfins	
Amia calva	Bowfin	BWFN
	ORDER OSTEOGLOSSIFORMES	
	Hiodontidae – mooneyes	
Hiodon alosoides	Goldeye	GDEY
Hiodon tergisus	Mooneye	MNEY
	ORDER ANGUILLIFORMES	
	Anguillidae – freshwater eels	
Anguilla rostrata	American Eel	AMEL
	ORDER CLUPEIFORMES	
	Clupeidae – herrings	
Alosa alabame	Alabama Shad	ALSD
Alosa chrysochloris	Skipjack Herring	SJHR
Alosa pseudoharengus	Alewife	ALWF
Dorosoma cepedianum	Gizzard Shad	GZSD
Dorosoma petenense	Threadfin Shad	TFSD

Appendix A. (continued).

Scientific name	Common name	Lettter Code
D. cepedianum X D. petenense	gizzard-threadfin shad hybrid	GSTS
	ORDER CYPRINIFORMES	
	Cyprinidae – carps and minnows	
Campostoma anomalum	Central Stoneroller	CLSR
Campostoma oligolepis	Largescale Stoneroller	LSSR
Carassius auratus	Goldfish	GDFH
Carassus auratus X Cyprinius carpio	goldfish-common carp hybrid	GFCC
Couesius plumbens	Lake Chub	LKCB
Ctenopharyngodon idella	Grass Carp	GSCP
Cyprinella lutrensis	Red Shiner	RDSN
Cyprinella spiloptera	Spotfin Shiner	SFSN
Cyprinus carpio	Common Carp	CARP
Erimystax x-punctatus	Gravel Chub	GVCB
Hybognathus argyritis	**Western Silvery minnow**	**WSMN***
Hybognathus hankinsoni	Brassy Minnow	BSMN
Hybognathus nuchalis	Mississippi Silvery Minnow	SVMW
Hybognathus placitus	**Plains Minnow**	**PNMW***
Hybognathus spp.	unidentified Hybognathus	HBNS
Hypophthalmichthys molitrix	Silver Carp	SVCP
Hypophthalmichthys nobilis	Bighead Carp	BHCP
Luxilus chrysocephalus	Striped Shiner	SPSN
Luxilus cornutus	Common Shiner	CMSN
Luxilus zonatus	Bleeding Shiner	BDSN
Lythrurus unbratilis	Western Redfin Shiner	WRFS
Macrhybopsis aestivalis	**Shoal Chub**	**SKCB***
Macrhybopsis gelida	**Sturgeon Chub**	**SGCB***
Macrhybopsis meeki	**Sicklefin Chub**	**SFCB***
Macrhybopsis storeriana	Silver Chub	SVCB
M. aestivalis X M. gelida	shoal-sturgeon chub hybrid	SPST
M. gelida X M. meeki	sturgeon-sicklefin chub hybrid	SCSC
Macrhybopsis spp.	unidentified chub	UHY
Margariscus margarita	Pearl Dace	PLDC
Mylocheilus caurinus	Peamouth	PEMT
Nocomis biguttatus	Hornyhead Chub	HHCB
Notemigonus crysoleucas	Golden Shiner	GDSN
Notropis atherinoides	Emerald Shiner	ERSN
Notropis blennius	River Shiner	RVSN
Notropis boops	Bigeye Shiner	BESN
Notropis buchanani	Ghost Shiner	GTSN
Notropis dorsalis	Bigmouth Shiner	BMSN
Notropis greenei	Wedgespot Shiner	WSSN
Notropis heterolepsis	Blacknose Shiner	BNSN
Notropis hudsonius	Spottail Shiner	STSN
Notropis nubilus	Ozark Minnow	OZMW
Notropis rubellus	Rosyface Shiner	RYSN
Notropis shumardi	Silverband Shiner	SBSN
Notropis stilbius	Silverstripe Shiner	SSPS
Notropis stramineus	**Sand Shiner**	**SNSN***
Notropis topeka	Topeka Shiner	TPSN
Notropis volucellus	Mimic Shiner	MMSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
	Cyprinidae – carps and minnows	
Notropis wickliffi	Channel Shiner	CNSN
Notropis spp.	unidentified shiner	UNO
Opsopoeodus emiliae	Pugnose Minnow	PNMW
Phenacobius mirabilis	Suckermouth Minnow	SMMW
Phoxinus eos	Northern Redbelly Dace	NRBD
Phoxinus erythrogaster	Southern Redbelly Dace	SRBD
Phoxinus neogaeus	Finescale Dace	FSDC
Pimephales notatus	Bluntnose Minnow	BNMW
Pimephales promelas	Fathead Minnow	FHMW
Pimephales vigilax	Bullhead Minnow	BHMW
Platygobio gracilis	Flathead Chub	FHCB
P. gracilis X M. meeki	flathead-sicklefin chub hybrid	FCSC
Rhinichthys atratulus	Blacknose Dace	BNDC
Rhinichthys cataractae	Longnose Dace	LNDC
Richardsonius balteatus	Redside Shiner	RDSS
Scardinius erythrophthalmus	Rudd	RUDD
Semotilus atromaculatus	Creek Chub	CKCB
	unidentified Cyprinidae	UCY
	unidentified Asian carp	UAC
	Catostomidae - suckers	
Carpiodes carpio	River Carpsucker	RVCS
Carpiodes cyprinus	Quillback	QLBK
Carpiodes velifer	Highfin Carpsucker	HFCS
Carpiodes spp.	unidentified Carpiodes	UCS
Catostomus catostomus	Longnose Sucker	LNSK
Catostomus commersonii	White Sucker	WTSK
Catostomus platyrhynchus	Mountain Sucker	MTSK
Catostomus spp.	unidentified *Catostomus* spp.	UCA
Cycleptus elongatus	**Blue Sucker**	**BUSK***
Hypentelium nigricans	Northern Hog Sucker	NHSK
Ictiobus bubalus	Smallmouth Buffalo	SMBF
Ictiobus cyprinellus	Bigmouth Buffalo	BMBF
Ictiobus niger	Black Buffalo	BKBF
Ictiobus spp.	unidentified buffalo	UBF
Minytrema melanops	Spotted Sucker	SPSK
Moxostoma anisurum	Silver Redhorse	SVRH
Moxostoma carinatum	River Redhorse	RVRH
Moxostoma duquesnei	Black Redhorse	BKRH
Moxostoma erythrurum	Golden Redhorse	GDRH
Moxostoma macrolepidotum	Shorthead Redhorse	SHRH
Moxostoma spp.	unidentified redhorse	URH
Catostomidae - suckers	unidentified Catostomidae	UCT
	ORDER SILURIFORMES	
	Ictaluridae – bullhead catfishes	
Ameiurus melas	Black Bullhead	BKBH
Ameiurus natalis	Yellow Bullhead	YLBH
Ameiurus nebulosus	Brown Bullhead	BRBH
Ameiurus spp.	unidentified bullhead	UBH
Ictalurus furcatus	Blue Catfish	BLCF

Appendix A. (continued).

Scientific name	Common name	Letter Code
Ictalurus punctatus	Channel Catfish	CNCF
I. furcatus X I. punctatus	blue-channel catfish hybrid	BCCC
Ictalurus spp.	unidentified *Ictalurus* spp.	UCF
Noturus exilis	Slender Madtom	SDMT
Noturus flavus	Stonecat	STCT
Noturus gyrinus	Tadpole Madtom	TPMT
Noturus nocturnus	Freckled Madtom	FKMT
Pylodictis olivaris	Flathead Catfish	FHCF
	ORDER SALMONIFORMES	
	Esocidae - pikes	
Esox americanus vermiculatus	Grass Pickerel	GSPK
Esox lucius	Northern Pike	NTPK
Esox masquinongy	Muskellunge	MSKG
E. lucius X E. masquinongy	Tiger Muskellunge	TGMG
	Umbridae - mudminnows	
Umbra limi	Central Mudminnow	MDMN
	Osmeridae - smelts	
Osmerus mordax	Rainbow Smelt	RBST
	Salmonidae - trouts	
Coregonus artedi	Lake Herring or Cisco	CSCO
Coregonus clupeaformis	Lake Whitefish	LKWF
Oncorhynchus aguabonita	Golden Trout	GDTT
Oncorhynchus clarkii	Cutthroat Trout	CTTT
Oncorhynchus kisutch	Coho Salmon	CHSM
Oncorhynchus mykiss	Rainbow Trout	RBTT
Oncorhynchus nerka	Sockeye Salmon	SESM
Oncorhynchus tshawytscha	Chinook Salmon	CNSM
Prosopium cylindraceum	Bonneville Cisco	BVSC
Prosopium williamsoni	Mountain Whitefish	MTWF
Salmo trutta	Brown Trout	BNTT
Salvelinus fontinalis	Brook Trout	BKTT
Salvelinus namaycush	Lake Trout	LKTT
Thymallus arcticus	Arctic Grayling	AMGL
	ORDER PERCOPSIFORMES	
	Percopsidae – trout-perches	
Percopsis omiscomaycus	Trout-Perch	TTPH
	ORDER GADIFORMES	
	Gadidae - cods	
Lota lota	Burbot	BRBT
	ORDER ATHERINIFORMES	
	Cyprinodontidae - killifishes	
Fundulus catenatus	Northern Studfish	NTSF
Fundulus diaphanus	Banded Killifish	BDKF
Fundulus notatus	Blackstripe Topminnow	BSTM
Fundulus olivaceus	Blackspotted Topminnow	BPTM
Fundulus sciadicus	Plains Topminnow	PTMW

Appendix A. (continued).

Scientific name	Common name	Letter Code
Fundulus zebrinus	Plains Killifish	PKLF
	Poeciliidae - livebearers	
Gambusia affinis	Western Mosquitofish	MQTF
	Atherinidae - silversides	
Labidesthes sicculus	Brook Silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	Gasterosteidae - sticklebacks	
Culaea inconstans	Brook Stickleback	BKSB
	ORDER SCORPAENIFORMES	
	Cottidae - sculpins	
Cottus bairdi	Mottled Sculpin	MDSP
Cottus carolinae	Banded Sculpin	BDSP
	ORDER PERCIFORMES	
	Percichthyidae – temperate basses	
Morone Americana	White Perch	WTPH
Morone chrysops	White Bass	WTBS
Morone mississippiensis	Yellow Bass	YWBS
Morone saxatilis	Striped Bass	SDBS
M. saxatilis X M. chrysops	striped-white bass hybrid	SBWB
	Centrarchidae - sunfishes	
Ambloplites rupestris	Rock Bass	RKBS
Archoplites interruptus	Sacramento Perch	SOPH
Lepomis cyanellus	Green Sunfish	GNSF
Lepomis gibbosus	Pumpkinseed	PNSD
Lepomis gulosus	Warmouth	WRMH
Lepomis humilis	Orangespotted Sunfish	OSSF
Lepomis macrochirus	Bluegill	BLGL
Lepomis megalotis	Longear Sunfish	LESF
Lepomis microlophus	Redear Sunfish	RESF
L. cyanellus X L. macrochirus	green sunfish-bluegill hybrid	GSBG
L. cyanellus X L. humilis	green-orangespotted sunfish hybrid	GSOS
L. macrochirus X L. microlophus	bluegill-redear sunfish hybrid	BGRE
Lepomis spp.	unidentified *Lepomis*	ULP
Micropterus dolomieu	Smallmouth Bass	SMBS
Micropterus punctulatus	Spotted Sunfish	STBS
Micropterus salmoides	Largemouth Bass	LMBS
Micropterus spp.	unidentified *Micropterus* spp.	UMC
Pomoxis annularis	White Crappie	WTCP
Pomoxis nigromaculatus	Black Crappie	BKCP
Pomoxis spp.	unidentified crappie	UCP
P. annularis X P. nigromaculatus	white-black crappie hybrid	WCBC
Centrarchidae	unidentified Centrarchidae	UCN
	Percidae - perches	
Ammocrypta asprella	Crystal Darter	CLDR

Appendix A. (continued).

Scientific name	Common name	Letter Code
Etheostoma blennioides	Greenside Darter	GSDR
Etheostoma caeruleum	Rainbow Darter	RBDR
Etheostoma exile	Iowa Darter	IODR
Etheostoma flabellare	Fantail Darter	FTDR
Etheostoma gracile	Slough Darter	SLDR
Etheostoma microperca	Least Darter	LTDR
Etheostoma nigrum	Johnny Darter	JYDR
Etheostoma punctulatum	Stippled Darter	STPD
Etheostoma spectabile	Orange Throated Darter	OTDR
Etheostoma tetrazonum	Missouri Saddled Darter	MSDR
Etheostoma zonale	Banded Darter	BDDR
Etheostoma spp.	unidentified Etheostoma spp.	UET
Perca flavescens	Yellow Perch	YWPH
Percina caprodes	Logperch	LGPH
Percina cymatotaenia	Bluestripe Darter	BTDR
Percina evides	Gilt Darter	GLDR
Percina maculata	Blackside Darter	BSDR
Percina phoxocephala	Slenderhead Darter	SHDR
Percina shumardi	River Darter	RRDR
Percina spp.	unidentified Percina spp.	UPN
	unidentified darter	UDR
Sander canadense	**Sauger**	**SGER***
Sander vitreus	Walleye	WLEY
S. canadense X S. vitreus	sauger-walleye hybrid/saugeye	SGWE
Sander spp.	unidentified *Sander* (formerly *Stizostedion*) spp.	UST
	unidentified Percidae	UPC
	Sciaenidae - drums	
Aplodinotus grunniens	Freshwater Drum	FWDM
	NON-TAXONOMIC CATEGORIES	
	Age-0/Young-of-year fish	YOYF
	no fish caught	NFSH
	unidentified larval fish	LVFS
	unidentified	UNID
	net malfunction (did not fish)	NDNF
	Turtles	
Chelydra serpentine	Common Snapping Turtle	SNPT
Chrysemys picta bellii	Western Painted Turtle	PATT
Emydoidea blandingii	Blanding's Turtle	BLDT
Graptemys pseudogeographica	False Map Turtle	FSMT
Trachemys scripta	Red-Eared Slider Turtle	REST
Apalone mutica	Smooth Softshell Turtle	SMST
Apalone spinifera	Spiny Softshell Turtle	SYST
Terrapene ornata ornata	Ornate Box Turtle	ORBT
Sternotherus odoratus	Stinkpot Turtle	SPOT
Graptemys geographica	Map Turtle	MAPT
Graptemys kohnii	Mississippi Map Turtle	MRMT
Graptemys ouachitensis	Ouachita Map Turtle	OUMT
Pseudemys concinna metteri	Missouri River Cooter Turtle	MRCT
Terrapene carolina triunguis	Three-toed Box Turtle	TTBT

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term Pallid Sturgeon and associated fish community sampling program.

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendritic	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m^3/s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m^3/s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri River fishes in Segment 13 for the long-term Pallid Sturgeon and associated fish community sampling program.

Gear	Code	Type	Season	Years	CPUE units
Gill Net – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	Fish / net night
Trammel Net – 1.0”inner mesh	TN	Standard	Sturgeon	2003 - 2009	Fish / 100 m drift
		Standard	Fish Comm.	2003 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2003 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2003 - Present	Fish / net night
Beam Trawl	BT	Standard	Both Seasons	2003 - 2004	Fish / 100 m trawled
Hoop Net – 4 ft.	HN	Standard	Both Seasons	2003 - 2004	Fish / net night
Trammel Net – 2.5” inner mesh	TN25	Standard	Sturgeon	2005 – 2006	Fish / 100 m drift
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 – 2005	Fish / 100 m^2
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag seine – rectangular method pulled downstream	BSRD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Evaluation	Fish Comm.	2006	Fish / 100 m trawled
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2007	Fish / m trawled
Trot Line	TL	Evaluation	Both Season	2009	Fish / 20 hook night
		Standard	Both Seasons	2010 - Present	Fish / 20 hook night

Appendix D. Stocking locations and codes for Pallid Sturgeon by Recovery Priority Management Area (RPMA) in the Missouri River Basin.

State(s)	RPMA	Site Name	Code	River	R.M.
MT	2	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124.0
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741.0
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KS/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult Pallid Sturgeon stocking summary for Segment 13 of the Missouri River (RPMA 4).

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking	Primary Mark	Secondary Mark
2002	Boonville	466	2001	4/3/2002	Yearling	PIT Tag	
2002	Boonville	1,767	2001	4/11/2002	Yearling	PIT Tag	
2002	Boonville	165	1999	4/25/2002	3 years	PIT Tag	Elastomer
2002	Boonville	344	2001	11/1/2002	Yearling	PIT Tag	Elastomer
2003	Boonville	1,441	2002	7/16/2003	Yearling	PIT Tag	
2003	Boonville	534	2002	9/4/2003	Yearling	PIT Tag	Elastomer
2003	Boonville	876	2002	10/24/2003	Yearling	PIT Tag	Elastomer
2003	Boonville	1,778	2003	12/2/2003	Fingerling	Coded Wire	Elastomer
2004	Boonville	774	2003	7/8/2004	Yearling	PIT Tag	Elastomer
2004	Boonville	916	2003	8/27/2004	Yearling	PIT Tag	Elastomer
2004	Boonville	9,761	2004	9/10/2004	Fingerling	Coded Wire	Elastomer
2004	Boonville	2,199	2004	10/8/2004	Fingerling	Coded Wire	Elastomer
2009	Grand River	558	2008	6/12/2009	Yearling	PIT Tag	Scute (4^{th} Right)
2011	Grand River	757	2011	9/28/2011	Fingerling	Elastomer	Scute (6^{th} Left)
2012	Grand River	2,368	2011	06/7/2012	Yearling	PIT Tag	Scute (6^{th} Left)
2012	Grand River	533	2011	10/18/2012	Yearling	PIT Tag	Scute (6^{th} Left)
2014	Glasgow	1,866	2014	9/18/2014	Fingerling	Elastomer	Scute (7^{th} Right)
2014	Hartsburg	2,087	2014	9/18/2014	Fingerling	Elastomer	Scute (7^{th} Right)

Appendix F

Appendix F. Total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 13 of the Missouri River during 2014. Species captured are listed alphabetically and their codes are presented in Appendix A. bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

Appendix F1. Gill net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	CHNB	POOL
BHCP	1	0.005	0	0	0.011	0	0	0		0		0	0
		0.009	0	0	0.022	0	0	0		0		0	0
BHMW	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
BKBF	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
BKCP	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
BLCF	112	0.509	0.222	0.773	0.289	0.767	0.6	1.292	0.25	0	0	0	0
		0.186	0.145	0.692	0.173	0.925	1.2	0.514	0.5	0	0	0	0
BLGL	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
BMBF	2	0.009	0	0	0	0	0	0	0	0	0	0	0.5
		0.018	0	0	0	0	0	0	0	0	0	0	1
BNMW	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
BUSK	**73**	**0.332**	**0.306**	**0.318**	**0.444**	**0.2**	**0**	**0.292**	**0.5**	**0**		**0**	**0**
		0.124	**0.216**	**0.31**	**0.247**	**0.273**	**0**	**0.358**	**0**	**0**		**0**	**0**
CARP	27	0.123	0	0.591	0.033	0.2	0	0.083	0	0		0	0.75
		0.099	0	0.829	0.038	0.273	0	0.112	0	0		0	1.5
CNCF	39	0.177	0.028	0.136	0.044	0.867	0	0.167		0		0	0.25
		0.185	0.056	0.141	0.043	1.318	0	0.188		0		0	0.5
CNLP	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
CNSN	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
ERSN	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
FHCF	1	0.005	0	0.045	0	0	0	0		0		0	0
		0.009	0	0.091	0	0	0	0		0		0	0
FWDM	6	0.027	0.028	0.045	0.011	0.067	0	0.042	0	0	0	0	0
		0.022	0.056	0.091	0.022	0.091	0	0.083	0	0	0	0	0
GDEY	69	0.314	0.194	0.864	0.256	0.233	0.7	0.208	0	0	0	0	0.25
		0.206	0.244	1.356	0.306	0.467	1.166	0.26	0	0		0	0.5
GDSN	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
GDSF	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
GNSF	0	0	0	0	0	0	0	0		0		0	0
		0	0	0	0	0	0	0		0		0	0
GSCP	32	0.145	0.028	0.455	0.089	0.267	0	0.125	0.25	0	0	0	0.25
		0.11	0.056	0.814	0.086	0.467	0	0.131	0.5	0	0	0	0.5

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	CHNB	POOL
GZSD	12	0.055	0.056	0.182	0.022	0.067	0	0.042	0	0		0	0.25
		0.044	0.076	0.364	0.031	0.091	0	0.083	0	0		0	0.5
HBNS	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**0**		**0**	
		0	**0**	**0**	**0**	**0**	**0**	**0**				**0**	
HFCS	0	0	0	0	0	0	0	0		0		0	
		0	0	0	0	0	0	0				0	
LKSG	1	0.005	0	0	0	0.033	0	0		0		0	
		0.009	0	0	0	0.067	0	0				0	
LMBS	0	0	0	0	0	0	0	0		0		0	
		0	0	0	0	0	0	0				0	
LNGR	51	0.232	0.028	0.364	0.389	0.1	0.4	0		0		0	
		0.306	0.056	0.541	0.733	0.145	0.583	0				0	
MNEY	1	0.005	0	0.045	0	0	0	0		0		0	
		0.009	0	0.091	0	0	0	0				0	
MQTF	0	0	0	0	0	0	0	0		0		0	
		0	0	0	0	0	0	0				0	
NHSK	0	0	0	0	0	0	0	0		0		0	
		0	0	0	0	0	0	0				0	
OSSF	0	0	0	0	0	0	0	0		0		0	
		0	0	0	0	0	0	0				0	
PDFH	1	0.005	0.028	0	0	0	0	0		0		0	
		0.009	0.056	0	0	0	0	0				0	
PDSG	**12**	**0.055**	**0.083**	**0.045**	**0.078**	**0**	**0.1**	**0**		**0**		**0**	
		0.033	**0.09**	**0.091**	**0.063**	**0**	**0.2**	**0**				**0**	
QLBK	2	0.009	0	0	0.011	0.033	0	0		0		0	
		0.013	0	0	0.022	0.067	0	0				0	
RDSN	0	0	0	0	0	0	0	0		0		0	
		0	0	0	0	0	0	0				0	
RVCS	24	0.109	0.028	0.591	0.022	0.133	0.1	0.083	0	0		0.25	0
		0.07	0.056	0.483	0.031	0.267	0.2	0.112	0			0.5	
SBWB	4	0.018	0	0.136	0	0.033	0	0		0		0	
		0.029	0	0.273	0	0.067	0	0				0	
SFCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**0**		**0**	
		0	**0**	**0**	**0**	**0**	**0**	**0**				**0**	
SGCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**0**		**0**	
		0	**0**	**0**	**0**	**0**	**0**	**0**				**0**	
SGER	**17**	**0.077**	**0.056**	**0**	**0.1**	**0.033**	**0.4**	**0.042**	**0**	**0**		**0**	**0**
		0.054	**0.111**	**0**	**0.098**	**0.067**	**0.583**	**0.083**	**0**	**0**		**0**	**0**
SHRH	8	0.036	0.028	0	0.011	0.067	0.1	0.042	0	0		0.5	0
		0.028	0.056	0	0.022	0.091	0.2	0.083	0	0		1	
SJHR	0	0	0	0	0	0	0	0	0	0		0	0
		0	0	0	0	0	0	0	0	0		0	
SKCB	0	0	0	0	0	0	0	0	0	0		0	0
		0	0	0	0	0	0	0	0	0		0	
SMBF	36	0.164	0.056	0.545	0.056	0.267	0	0.125	0	0		0	1.5
		0.101	0.076	0.563	0.057	0.401	0	0.131	0			0	3

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	CHNB	POOL
SNGR	26	0.118	0.056	0.346	0.111	0	0.1	0.125	0		**0**	0	0.5
		0.068	0.076	0.384	0.105	0	0.2	0.25	0			0	1
SNPD	2	0.009	0	0	0.011	0.033	0	0	0		0	0	0
		0.013	0	0	0.022	0.067	0	0	0			0	
SNSG	**1610**	**7.318**	**4.694**	**18.364**	**4.989**	**9.433**	**5**	**9.583**	**3**		**0**	**0**	**3.25**
		1.912	**2.532**	**13.873**	**1.645**	**4.968**	**4.347**	**3.823**	**2**			**0**	**6.5**
SNSN	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
STBS	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
STCT	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
STGR	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
SVCB	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
SVCP	14	0.064	0.028	0.273	0.033	0.067	0.1	0.042	0		0	0	0
		0.037	0.056	0.247	0.038	0.091	0.2	0.083	0			0	
UBF	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UCN	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UCS	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UCT	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UCY	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UGR	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UHR	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UHY	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UIC	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
UNID	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
USG	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
WLEY	1	0.005	0	0.045	0	0	0	0	0		0	0	0
		0.009	0	0.091	0	0	0	0	0			0	
WTBS	2	0.009	0	0.091	0	0	0	0	0		0	0	0
		0.013	0	0.122	0	0	0	0	0			0	
WTCP	0	0	0	0	0	0	0	0	0		0	0	0

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	CHNB	POOL
		0	0	0	0	0	0	0	0			0	
WTSK	12	0.055	0	0	0	0	0	0	0		0	0	3
		0.109	0	0	0	0	0	0	0			0	6
YLBH	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	
YOYF	0	0	0	0	0	0	0	0	0		0	0	0
		0	0	0	0	0	0	0	0			0	

Appendix F2. 1.0” trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	TRML
			CHNB	CHNB	CHNB	POOL
BHMW	0	0	0	0	0	0
		0	0	0		
BKBH	0	0	0	0	0	0
		0	0	0		
BKCP	0	0	0	0	0	0
		0	0	0		
BKSS	0	0	0	0	0	0
		0	0	0		
BLCF	7	0.073	0.166	0.055	0	0
		0.055	0.227	0.049		
BLGL	0	0	0	0	0	0
		0	0	0		
BMBF	0	0	0	0	0	0
		0	0	0		
BNMW	0	0	0	0	0	0
		0	0	0		
BUSK	**45**	**0.386**	**0.572**	**0.35**	**0**	**0**
		0.194	**0.853**	**0.168**		
CARP	0	0	0	0	0	0
		0	0	0		
CNCF	6	0.081	0	0.097	0	0
		0.065	0	0.077		
CNSN	0	0	0	0	0	0
		0	0	0		
ERSN	0	0	0	0	0	0
		0	0	0		
FHCF	2	0	0	0	0	0
		0	0	0		
FWDM	3	0	0	0	0	0
		0	0	0		
GDEY	5	0	0	0	0	0
		0	0	0		
GDFH	0	0	0	0	0	0
		0	0	0		
GDRH	0	0	0	0	0	0
		0	0	0		
GNSF	0	0	0	0	0	0
		0	0	0		
GSCP	3	0	0	0	0	0
		0	0	0		
GSOS	0	0	0	0	0	0
		0	0	0		
GZSD	0	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	TRML
			CHNB	CHNB	CHNB	POOL
		0	0	0		
HBNS	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		
HFCS	0	0	0	0	0	0
		0	0	0		
LKSG	0	0	0	0	0	0
		0	0	0		
LNGR	3	0.04	0	0.047	0	0
		0.046	0	0.054		
MMSN	0	0	0	0	0	0
		0	0	0		
MQTF	0	0	0	0	0	0
		0	0	0		
OSSF	0	0	0	0	0	0
		0	0	0		
PDFH	0	0	0	0	0	0
		0	0	0		
PDSG	**5**	**0.052**	**0.078**	**0.046**	**0**	**0**
		0.047	**0.157**	**0.047**		
QLBK	4	0.047	0.152	0.027	0	0
		0.058	0.304	0.038		
RBTT	0	0	0	0	0	0
		0	0	0		
RDSN	0	0	0	0	0	0
		0	0	0		
RVCS	4	0.045	0.078	0.039	0	0
		0.048	0.157	0.049		
RVRH	0	0	0	0	0	0
		0	0	0		
RVSN	0	0	0	0	0	0
		0	0	0		
SBWB	0	0	0	0	0	0
		0	0	0		
SFCB	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		
SGCB	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		
SGER	**1**	**0.007**	**0**	**0.008**	**0**	**0**
		0.013	**0**	**0.016**		
SHRH	0	0	0	0	0	0
		0	0	0		
SKCB	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		
SMBF	3	0.034	0.083	0.025	0	0
		0.039	0.166	0.035		
SNGR	0	0	0	0	0	0.667

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	TRML
			CHNB	CHNB	CHNB	POOL
		0	0	0		
SNPD	1	0.011	0	0.014	0	0
		0.023	0	0.027		
SNSG	**454**	**4.476**	**3.158**	**4.729**	**0**	**0**
		1.506	**4.105**	**1.619**		
STCT	0	0	0	0	0	0
		0	0	0		
SVCB	0	0	0	0	0	0
		0	0	0		
SVCP	0	0	0	0	0	0
		0	0	0		
UCF	0	0	0	0	0	0
		0	0	0		
UCN	0	0	0	0	0	0
		0	0	0		
UCS	0	0	0	0	0	0
		0	0	0		
UCT	0	0	0	0	0	0
		0	0	0		
UCY	0	0	0	0	0	0
		0	0	0		
UHY	0	0	0	0	0	0
		0	0	0		
UIC	0	0	0	0	0	0
		0	0	0		
UNID	0	0	0	0	0	0
		0	0	0		
UNO	0	0	0	0	0	0
		0	0	0		
USG	0	0	0	0	0	0
		0	0	0		
WLYE	0	0	0	0	0	0
		0	0	0		
WTBS	0	0	0	0	0	0
		0	0	0		
WTCP	0	0	0	0	0	0
		0	0	0		
WTSK	0	0	0	0	0	0
		0	0	0		
YLBH	0	0	0	0	0	0
		0	0	0		
YOYF	0	0	0	0	0	0
		0	0	0		

Appendix F3. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO			CONF	ISB			OSB		SCCL		TRML
			BARS	CHNB	POOL	CHNB	BARS	CHNB	POOL	CHNB	POOL	BARS	CHNB	CHNB
BHMW	9	0.048	0	0.168	0		0	0.029		0	0		0	0
		0.051		0.267	0		0	0.039		0				
BKBH	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
BKCP	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
BKSS	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
BLCF	155	0.571	0	1.017	1.688		0	0.411	0.8	0	0.64		0.337	2.461
		0.157		0.479	2.512		0	0.136		0	0.642		0.475	1.329
BLGL	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
BMBF	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
BNMW	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
BUSK	**27**	**0.093**	**0**	**0.033**	**0**		**0.778**	**0.108**		**0**	**0**		**0.167**	**0**
		0.043		**0.043**	**0**		**0**	**0.054**		**0**			**0.193**	
CARP	2	0.007	0	0	0		0	0.004		0	0		0	0.313
		0.009		0	0		0	0.009		0				0.625
CNCF	820	2.494	0	2.595	0.88		0.778	2.633		0	2.315	4.444	0.337	2.188
		0.522		1.095	1.385		0	0.65		0	3.002		0.475	4.375
CNLP	1	0.005	0	0	0	0		0		0	0.303		0	0
		0.01	0	0	0	0		0		0	0.606		0	0
CNSN	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
ERSN	19	0.105	0	0	0		0	0.012		0	0		0	0
		0.18		0	0		0	0.012		0				
FHCF	6	0.019	0	0.059	0		0	0.012		0	0		0	0
		0.016		0.085	0		0	0.012		0				
FWDM	24	0.101	0	0.099	1.247		0	0.035		0	0.303		0	1.198
		0.061		0.112	1.116		0	0.033		0	0.606		0	2.395
GDEY	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0	0		0	0
GDFH	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
GDRH	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
GNSF	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
GSCP	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				

Species	Total Catch	Overall CPUE	CHXO			CONF	ISB			OSB			SCCL	TRML
			BARS	CHNB	POOL	CHNB	BARS	CHNB	POOL	CHNB	POOL	BARS	CHNB	CHNB
GSOS	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
GZSD	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
HBNS	**1**	**0.004**	**0**	**0**	**0**		**0**	**0**		**0**	**0**	**0.741**	**0**	**0**
		0008		**0**	**0**		**0**	**0**		**0**				
HFCS	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
LKSG	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
LMBS	1	0.002	0	0	0		0	0.003		0	0		0	0
		0.005		0	0		0	0.006		0				
LNGR	2	0.008	0	0.032	0		0	0		0	0		0	0.299
		0.012		0.063	0		0	0		0				0.599
MMSN	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
MQTF	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
NFSH	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
OSSF	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
PDFH	3	0.013	0	0	0		0	0.018		0	0		0	0
		0.019		0	0		0	0.026		0				
PDSG	**3**	**0.008**	**0**	**0**	**0**		**0**	**0.01**		**0**	**0**		**0**	**0**
		0.009		**0**	**0**		**0**	**0.012**		**0**				
QLBK	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
RBTT	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
RDSN	21	0.107	0	0.163	0.168		0	0.102		0	0		0	0
		0.091		0.198	0.337		0	0.114		0				
RVCS	9	0.039	0	0.07	0.141		0	0.011	1.6	0	0.427		0	0
		0.03		0.097	0.282		0	0.013		0	0.855			
RVRH	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
RVSN	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
SBWB	0	0	0	0	0		0	0		0	0		0	0
		0		0	0		0	0		0				
SFCB	**438**	**1.411**	**0**	**1.688**	**1.748**		**0.778**	**1.398**	**1.6**	**0**	**0**		**1.09**	**0.938**
		0.34		**0.945**	**1.65**		**0**	**0.403**		**0**			**1.319**	**1.875**
SGCB	**223**	**0.556**	**0**	**0.123**	**0**		**0**	**0.692**		**0**	**0**	**0.741**	**0.835**	**0**
		0.289		**0.135**	**0**		**0**	**0.383**		**0**			**1.109**	
SGER	**3**	**0.008**	**0**	**0**	**0**		**0**	**0.009**		**0**	**0**		**0.084**	**0**
		0.013		**0**	**0**		**0**	**0.017**		**0**				

Species	Total Catch	Overall CPUE	CHXO			CONF	ISB		OSB		SCCL		TRML
			BARS	CHNB	POOL	CHNB	BARS	CHNB	CHNB	POOL	BARS	CHNB	CHNB
SHRH	1	0.003	0	0	0		0	0.005	0	0		0	0
		0.007		0	0		0	0.009	0				
SKCB	**591**	**1.947**	**0**	**2.797**	**0.174**		**1.167**	**1.872**	**0**	**1.158**	**1.481**	**3.345**	**0.417**
		0.63		**1.903**	**0.347**		**0**	**0.736**	**0**	**1.501**		**2.506**	
SMBF	2	0.011	0	0.042	0		0	0.006	0	0		0	0
		0.016		0.083	0		0	0.013	0				
SNGR	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
SNPD	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
SNSG	**488**	**1.611**	**0**	**1.541**	**1.459**		**1.556**	**1.685**	**0**	**0**		**0.168**	**5**
		0.415		**0.783**	**2.064**		**0**	**0.508**	**0**			**0.194**	**10**
STCT	5	0.015	0	0	0		0	0.02	0	0		0	0
		0.015		0	0		0	0.02	0				
SVCB	23	0.067	0	0.093	0		0	0.065	0	0	0.741	0	0
		0.029		0.106	0		0	0.03	0				
SVCP	13	0.046	0	0.04	0.208		0	0.029	0	0.673		0	0
		0.032		0.059	0.417		0	0.022	0	1.347			
UCF	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
UCN	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
UCS	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
UCT	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
UCY	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
UHY	4	0.013	0	0.045	0		0	0.008	0	0		0	0
		0.016		0.091	0		0	0.009	0				
UIC	4	0.022	0	0	0.377		0	0.013	0	0		0	0
		0.022		0	0.479		0	0.018	0				
UNID	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
UNO	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
USG	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				
WLYE	0	0	0	0	0		0	0	0	0		0	0
		0		0	0		0	0	0				

Species	Total Catch	Overall CPUE	CHXO			CONF	ISB		OSB		SCCL	TRML
			BARS	CHNB	POOL	CHNB	BARS	CHNB	CHNB	POOL	CHNB	CHNB
WTBS	0	0 0	0	0 0	0 0		0 0	0 0	0 0	0	0	0
WTCP	0	0 0	0	0 0	0 0		0 0	0 0	0 0	0	0	0
WTSK	0	0 0	0	0 0	0 0		0 0	0 0	0 0	0	0	0
YLBH	0	0 0	0	0 0	0 0		0 0	0 0	0 0	0	0	0
YOTF	0	0 0	0	0 0	0 0		0 0	0 0	0 0	0	0	0

Appendix F4. Mini-fyke net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
BHCP	6	0.069	0		0.087	0.125		0		0	
		0.097	0		0.174	0.171		0		0	
BHMW	79	0.908	1		0.891	0.813	1	0	0	0	1.6
		0.32	0.577		0.432	0.735		0		0	2.728
BKBH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
BKCP	5	0.057	0		0.087	0.063		0	0	0	0
		0.06	0		0.105	0.125		0		0	0
BKSS	6	0.069	0.313		0	0		0	0	0	0
		0.117	0.625		0	0		0		0	0
BLCF	1	0.011	0		0.022	0		0	0	0	0
		0.023	0		0.043	0		0		0	0
BLGL	47	0.54	0.313		0.5	0.938		0	0	0	0.8
		0.24	0.352		0.309	0.865		0		0	0.4
BMBF	1	0.011	0		0.022	0		0	0	0	0
		0.023	0		0.043	0		0		0	0
BNMW	53	0.609	0.75		0.739	0.063		0	0	0	1.2
		0.392	0.719		0.647	0.125		0		0	2.4
BTTM	**3**	**0.034**	**0.063**		**0.022**	**0.063**		**0**	**0**	**0**	**0**
		0.039	**0.125**		**0.043**	**0.125**		**0**		**0**	**0**
BUSK	**0**	**0**	**0**		**0**	**0**		**0**	**0**	**0**	**0**
		0	**0**		**0**	**0**		**0**		**0**	**0**
CARP	87	1	0.875		0.084	1.438	2	2.667	0	0	0.6
		0.459	0.68		0.484	1.853		3.333		0	1.2
CNCF	90	1.034	1		1.13	1.125	0	1.33	0	0	0
		0.379	0.931		0.555	0.911		0.667		0	0
CNSN	44	0.506	1.625		0.239	0.438		0	0	0	0
		0.36	1.672		0.217	0.632		0		0	0
ERSN	79	0.908	2.188		0.891	0.125		0.333	0	0	0
		0.707	2.564		0.977	0.25		0.667		0	0
FHCF	1	0.011	0		0.022	0		0	0	0	0
		0.023	0		0.043	0		0		0	0
FHMW	5	0.057	0		0.022	0		0	0	0	0
		0.023	0		0.043	0	0	0		0	0
FWDM	1068	12.276	8.563		14.522	10.25	11	3.333	0	0	15.6
		8.04	6.372		14.557	8.445		2.906		0	27.237
GDEY	2	0.023	0		0.043	0		0	0	0	0
		0.046	0		0.087	0		0		0	0
GDFH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
GDRH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
GNSF	14	0.161	0.063		0.261	0.063		0	0	0	0

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
		0.117	0.125		0.125	0.125		0		0	0
GSCP	13	0.149	0		0.152	0.188		0.333	0	0	0.4
		0.095	0		0.124	0.272		0.667		0	0.8
GSOS	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
GZSD	53	0.609	0.188		0.478	1		0	0	0	2.4
		0.274	0.375		0.29	0.894		0		0	1.855
HBNS	**45**	**0.517**	**0.5**		**0.478**	**0.938**		**0**	**0**	**0**	**0**
		0.44	**1**		**0.599**	**1.36**		**0**		**0**	**0**
HFCS	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
LGPH	1	0.011	0.063		0	0		0	0	0	0
		0.023	0.125		0	0		0		0	0
LKSG	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
LMBS	2	0.023	0.063		0.022	0		0	0	0	0
		0.032	0.125		0.043	0		0		0	0
LNGR	42	0.483	0.625		0.435	0.375		0	0	0	1.2
		0.204	0.403		0.238	0.31		0		0	2.4
MMSN	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
MQTF	230	2.644	2.938		3.935	0.125		0	0	0	0
		2.25	5.114		3.847	0.171		0		0	0
NFSH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
OSSF	24	0.276	0.188		0.304	0.375		0	0	0	0.2
		0.125	0.202		0.185	0.359		0		0	0.4
PDFH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
PDSG	**0**	**0**	**0**		**0**	**0**		**0**	**0**	**0**	**0**
		0	**0**		**0**	**0**		**0**		**0**	**0**
PNMW	**9**	**0.103**	**0.063**		**0.174**	**0**		**0**	**0**	**0**	**0**
		0.113	**0.125**		**0.209**	**0**		**0**		**0**	**0**
QLBK	3	0.034	0		0.067	0		0	0	0	0
		0.069	0		0.133	0		0		0	0
RBTT	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
RDSN	630	7.241	12.125		7.435	4.625		4	0	0	1.6
		3.054	7.213		5.052	2.235		6.11		0	2.059
RVCS	17	0.195	0.25		0.196	0		1.333	0	0	0
		0.134	0.289		0.193	0		1.764		0	0
RVRH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
RVSN	1	0.011	0		0.022	0		0	0	0	0
		0.023	0		0.043	0		0		0	0
SBWB	1	0.011	0		0	0		0	0	0	0.2

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
		0.023	0		0	0		0		0	0.4
SFCB	**3**	**0.034**	**0**		**0.065**	**0**		**0**	**0**	**0**	**0**
		0.069	**0**		**0.13**	**0**		**0**		**0**	**0**
SGCB	**0**	**0**	**0**		**0**	**0**		**0**	**0**	**0**	**0**
		0	**0**		**0**	**0**		**0**		**0**	**0**
SGER	**1**	**0.011**	**0.063**		**0**	**0**		**0**	**0**	**0**	**0**
		0.023	**0.125**		**0**	**0**		**0**		**0**	**0**
SHRH	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
SKCB	5	0.057	0		0.043	0		0.667	0	0	0.2
		0.05	0		0.061	0		0.667		0	0.4
SMBF	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
SMMW	2	0.023	0.125		0	0		0	0	0	0
		0.032	0.171		0	0		0		0	0
SNGR	110	1.264	1.25		1.37	1.313		0.333	0	0	1
		0.559	1.147		0.882	1.221		0.667		0	1.265
SNPD	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
SNSG	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
SNSN	19	0.218	0.438		0.239	0		0.333	0	0	0
		0.195	0.657		0.286	0		0.667		0	0
STBS	4	0.046	0.063		0.043	0.063		0	0	0	0
		0.045	0.125		0.061	0.125		0		0	0
STCT	1	0.011	0		0	0.063		0	0	0	0
		0.023	0		0	0.125		0		0	0
SVCB	30	0.345	0.563		0.217	0.438		1	0	0	0.2
		0.16	0.547		0.151	0.446		1.155		0	0.4
SVCP	1066	12.253	7.063		9.13	17.75	4	52	0	0	17.8
		6.519	10.449		5.848	24.942		60.144		0	35.102
UAC	155	1.782	0.875		2.565	0.12	4	5.667	0	0	0
		1.848	0.946		3.401	0.25		11.333		0	0
UBF	20	0.23	0.188		0.37	0		0	0	0	0
		0.244	0.202		0.454	0		0		0	0
UCF	2	0.023	0		0.022	0	1	0	0	0	0
		0.032	0		0.043	0		0		0	0
UCN	61	0.701	0.063		0.652	1		0	0	0	2.8
		0.446	0.125		0.486	1		0		0	5.6
UCS	27	0.31	0.438		0.326	0.125	1	0.667	0	0	0
		0.232	0.547		0.378	0.25		1.333		0	0
UCT	497	5.713	0.5		10.457	0.313		0	0	0	0.6
		7.198	0.447		13.526	0.301		0		0	1.2
UCY	77	0.885	0.313		1.348	0.563		0	0	0	0.2
		0.936	0.437		1.751	0.547		0		0	0.4

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
UDR	1	0.011	0		0.022	0		0	0	0	0
		0.023	0		0.043	0		0		0	0
UGR	6	0.069	0.063		0	0.313		0	0	0	0
		0.064	0.125		0	0.301		0		0	0
UHR	24	0.276	0.063		0.239	0.688		0	0	0	0.2
		0.203	0.125		0.293	0.676		0		0	0.4
UHY	1	0.011	0		0.022	0		0	0	0	0
		0.023	0		0.043	0		0		0	0
UIC	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
ULP	5	0.057	0		0.109	0		0	0	0	0
		0.115	0		0.217	0		0		0	0
UNID	21	0.241	0		0.391	0	3	0	0	0	0
		0.249	0		0.45	0		0		0	0
UNO	2	0.023	0		0.044	0		0	0	0	0
		0.032	0		0.062	0		0		0	0
USG	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
WLYE	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
WTBS	11	0.126	0		0.109	0.313		0	0	0	0
		0.079	0.063		0.093	0.301	1	0		0	0
WTCP	21	0.241	0.125		0.304	0.313		0	0	0	0.2
		0.17	0		0.291	0.352		0		0	0.4
WTSK	0	0	0		0	0		0	0	0	0
		0	0		0	0		0		0	0
YLBH	5	0.057	0		0.087	0.063		0	0	0	0
		0.06	0		0.105	0.125		0		0	0
YOYF	6	0.069	0		0.109	0.063		0	0	0	0
		0.117	0		0.217	0.125		0		0	0
YWBS	1	0.011	0		0	0		0	0	0	0.2
		0.023	0		0	0		0		0	0.4

Appendix F5. Trot lines: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	POOL
AMEL	1	0.005	0	0	0.012	0	0	0	0	0	0	0
		0.011	0	0	0.023	0	0	0	0	0	0	0
BCCC	1	0.005	0	0	0.012	0	0	0	0	0	0	0
		0.011	0	0	0.023	0	0	0	0	0	0	0
BHCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BHMW	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BKBF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BKCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BLCF	223	1.225	1.225	1.056	0.721	1.722	2	3.125	0.75	0	0	0.75
		0.319	0.319	0.588	0.328	1.082	1.067	3.326	0.5	0	0	1.5
BLGL	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BMBF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BNMW	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0
BUSK	**1**	**0.005**	**0**	**0**	**0.012**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0.011	**0**	**0**	**0.023**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CARP	1	0.005	0.028	0	0	0	0	0	0	0	0	0
		0.011	0.056	0	0	0	0	0	0	0	0	0
CNCF	53	0.291	0.222	0.25	0.337	0.278	0.222	0.5	0.25	0	0	0
		0.094	0.166	0.5	0.148	0.242	0.176	1	0.5	0	0	0
CNLP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
CNSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
ERSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
FHCF	1	0.006	0	0	0	0	0	0.167	0	0	0	0
		0.011	0	0	0	0	0	0.333		0		
FWDM	23	0.126	0.139	0	0.105	0.056	0.333	0.25	0	0	0	0
		0.066	0.135	0	0.091	0.111	0.333	0.5		0		
GDEY	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
GDSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
GNSF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	POOL
GSCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
GZSD	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
HBNS	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**	**0**		0		
HFCS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
LKSG	4	0.022	0.028	0.25	0.012	0	0	0	0	0	0	0
		0.022	0.056	0.289	0.023	0	0	0		0		
LMBS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
LNGR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
MNEY	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
MQTF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
NFSH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
NHSK	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
OSSF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
PDFH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
PDSG	**8**	**0.044**	**0.083**	**0**	**0.035**	**0.056**	**0.056**	**0**	0	0	0	0
		0.037	**0.121**	**0**	**0.052**	**0.111**	**0.111**	**0**		0		
QLBK	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
RDSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
RVCS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SFCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**	**0**		0		
SGCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**	**0**		0		
SGER	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**	**0**		0		
SHRH	**0**	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SJHR	**0**	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SKCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**	**0**		0		

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	POOL
SMBF	**4**	0.022	0.028	0	0	0	0.111	0.125	0	0	0	0
		0.027	0.056	0	0	0	0.222	0.25		0		
SMMW	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SNGR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SNPD	**5**	0.027	0	0	0.012	0.056	0.111	0	0	0	0	0.25
		0.029	0	0	0.023	0.111	0.222	0		0		0.5
SNSG	**1122**	**6.165**	**5.528**	**10**	**5.023**	**9**	**7.222**	**7.25**	0.75	0	0	14.5
		1.133	**2.682**	**6.819**	**1.552**	**2.041**	4.038	**3.775**	0.5	0		8
SNSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
STBS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
STCT	1	0.005	0	0	0	0.056	0	0	0	0	0	0
		0.011	0	0	0	0.111	0	0		0		
STGR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SVCB	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
SVCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UBF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UCN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UCS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UCT	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UCY	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UGR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UHR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UHY	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UIC	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
UNID	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
USG	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
WLEY	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL			TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	POOL
WTBS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
WTCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
WTSK	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		
YLBH	1	0.005	0	0.125	0	0	0	0	0	0	0	0
		0.011	0	0.25	0	0	0	0		0		
YOYF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0		0		

Appendix G. Hatchery names, locations and abbreviations.

Hatchery	State	Abbreviation
Blind Pony State Fish Hatchery	MO	BYP
Neosho National Fish Hatchery	MO	NEO
Gavins Point National Fish Hatchery	SD	GAV
Garrison Dam National Fish Hatchery	ND	GAR
Miles City State Fish Hatchery	MT	MCH
Blue Water State Fish Hatchery	MT	BLU
Bozeman Fish Technology Center	MT	BFT
Fort Peck State Fish Hatchery	MT	FPH

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2014 for Segment 13 of the Missouri River.

Species Code	**Sturgeon Season**		**Fish Community Season**			**Both Seasons**
	Gill Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
AMEL	0.000	0.000	0.000	0.000	0.000	0.005
BCCC	0.000	0.000	0.000	0.000	0.000	0.005
BHCP	0.005	0.000	0.000	0.069	0.000	0.000
BHMW	0.000	0.091	0.000	0.908	0.004	0.000
BKBH	0.000	0.000	0.000	0.000	0.000	0.000
BKCP	0.000	0.000	0.000	0.069	0.000	0.000
BKSS	0.000	0.000	0.000	0.000	0.000	0.000
BLCF	0.509	0.557	0.073	0.011	0.585	1.225
BLGL	0.000	0.000	0.000	0.540	0.000	0.000
BMBF	0.009	0.000	0.000	0.011	0.000	0.000
BNMW	0.000	0.000	0.000	0.609	0.000	0.000
BTTM	**0.000**	**0.000**	**0.000**	**0.034**	**0.000**	**0.000**
BUSK	**0.332**	**0.102**	**0.386**	**0.000**	**0.085**	**0.005**
CARP	0.123	0.006	0.000	1.000	0.007	0.005
CNCF	0.177	2.144	0.081	1.034	2.864	0.291
CNLP	0.000	0.010	0.000	0.000	0.000	0.000
CNSN	0.000	0.000	0.000	0.506	0.000	0.000
ERSN	0.000	0.204	0.000	0.908	0.000	0.000
FHCF	0.005	0.022	0.000	0.011	0.015	0.000
FHMW	0.000	0.000	0.000	0.057	0.000	0.000
FWDM	0.027	0.145	0.000	0.057	0.000	0.000
GDEY	0.314	0.000	0.000	0.023	0.000	0.000
GDFH	0.000	0.000	0.000	0.000	0.000	0.000
GDRH	0.000	0.000	0.000	0.000	0.000	0.000
GNSF	0.000	0.000	0.000	0.161	0.000	0.000
GSCP	0.145	0.000	0.000	0.149	0.000	0.000
GSOS	0.000	0.000	0.000	0.000	0.000	0.000
GZSD	0.055	0.000	0.000	0.609	0.000	0.000
HBNS	**0.000**	**0.000**	**0.000**	**0.517**	**0.008**	**0.000**
HFCS	0.000	0.000	0.000	0.000	0.000	0.000
LGPH	0.000	0.000	0.000	0.011	0.000	0.000
LKSG	0.005	0.000	0.000	0.000	0.000	0.022
LMBS	0.000	0.004	0.000	0.023	0.000	0.000

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
LNGR	0.232	0.000	0.040	0.483	0.017	0.000
MMSN	0.000	0.000	0.000	0.000	0.000	0.000
MQTF	0.000	0.000	0.000	2.644	0.000	0.000
NFSH	0.000	0.000	0.000	0.000	0.000	0.000
OSSF	0.000	0.000	0.000	0.276	0.000	0.000
PDFH	0.005	0.026	0.000	0.000	0.000	0.000
PDSG	**0.055**	**0.006**	**0.052**	**0.000**	**0.010**	**0.044**
PNMW	**0.000**	**0.000**	**0.000**	**0.103**	**0.000**	**0.000**
QLBK	0.009	0.000	0.047	0.000	0.000	0.000
RBTT	0.000	0.000	0.000	0.000	0.000	0.000
RDSN	0.000	0.209	0.000	7.241	0.000	0.000
RVCS	0.109	0.073	0.045	0.195	0.004	0.000
RVRH	0.000	0.000	0.000	0.000	0.000	0.000
RVSN	0.000	0.000	0.000	0.011	0.000	0.000
SBWB	0.018	0.000	0.000	0.011	0.000	0.000
SFCB	**0.000**	**1.357**	**0.000**	**0.034**	**1.467**	**0.000**
SGCB	**0.000**	**0.954**	**0.000**	**0.000**	**0.135**	**0.000**
SGER	**0.077**	**0.012**	**0.007**	**0.011**	**0.004**	**0.000**
SHRH	0.036	0.007	0.000	0.000	0.000	0.000
SKCB	**0.000**	**3.001**	**0.000**	**0.057**	**0.833**	**0.000**
SMBF	0.164	0.022	0.034	0.000	0.000	0.022
SMMW	0.000	0.000	0.000	0.023	0.000	0.000
SNGR	0.118	0.000	0.000	1.264	0.000	0.000
SNPD	0.009	0.000	0.011	0.000	0.000	0.027
SNSG	**7.318**	**1.403**	**4.476**	**0.000**	**1.831**	**6.165**
STBS	**0.000**	**0.000**	**0.000**	**0.046**	**0.000**	**0.000**
STCT	**0.000**	**0.029**	**0.000**	**0.011**	**0.000**	**0.005**
SVCB	0.000	0.085	0.000	0.345	0.049	0.000
SVCP	0.064	0.049	0.000	12.253	0.042	0.000
UAC	0.000	0.000	0.000	1.782	0.000	0.000
UBF	0.000	0.000	0.000	0.230	0.000	0.000
UCF	0.000	0.000	0.000	0.023	0.000	0.000
UCN	0.000	0.000	0.000	0.701	0.000	0.000
UCS	0.000	0.000	0.000	0.310	0.000	0.000
UCT	0.000	0.000	0.000	5.713	0.000	0.000
UCY	0.000	0.000	0.000	0.885	0.000	0.000

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
UDR	0.000	0.000	0.000	0.011	0.000	0.000
UHR	0.000	0.000	0.000	0.276	0.000	0.000
UHY	0.000	0.000	0.000	0.011	0.027	0.000
UIC	0.000	0.024	0.000	0.000	0.019	0.000
ULP	0.000	0.000	0.000	0.057	0.000	0.000
UNID	0.000	0.000	0.000	0.241	0.000	0.000
UNO	0.000	0.000	0.000	0.000	0.000	0.000
USG	0.000	0.000	0.000	0.000	0.000	0.000
WLYE	0.005	0.000	0.000	0.000	0.000	0.000
WTBS	0.009	0.000	0.000	0.126	0.000	0.000
WTCP	0.000	0.000	0.000	0.241	0.000	0.000
WTSK	0.055	0.000	0.000	0.000	0.000	0.000
YLBH	0.000	0.000	0.000	0.057	0.000	0.005
YOYF	0.000	0.000	0.000	0.011	0.000	0.000
YWBS	0.000	0.000	0.000	0.011	0.000	0.000

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 13 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2003 - 2014.

Bend Number	Bend RM	Coordinates Lat	Long	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	132.6	38.58370	-91.98935	FC		ST				ST, FC			ST, FC	ST, FC	
2	134.7	38.56614	-92.02019											ST, FC	
3	135.9	38.56129	-92.04077	ST		FC							ST, FC		
4	137.6	38.55783	-92.07141				ST, FC	ST, FC							
5	138.9	38.55951	-92.09576			ST									ST, FC
6	142.0	38.57389	-92.14883	FC		ST					ST, FC		ST, FC		
7	143.5	38.58442	-92.17298		FC	FC		ST, FC	ST, FC						
8	146.0	38.60902	-92.20325								ST, FC		ST, FC	ST, FC	
9	149.5	38.64572	-92.23152	ST	FC						ST, FC	ST, FC			
10	151.6	38.64979	-92.26655	ST			ST, FC								
11	154.8	38.67036	-92.31632			ST			ST, FC	ST, FC		ST, FC			ST, FC
12	158.7	38.69745	-92.35399		FC	ST									
13	162.3	38.73236	-92.36921	FC			ST, FC	ST, FC		ST, FC					
14	166.8	38.77592	-92.40073	ST				ST, FC							
15	171.3	38.81963	-92.40320		FC	ST					ST, FC			ST, FC	
16	174.4	38.84120	-92.44640		ST	FC		ST, FC							
17	176.6	38.86762	-92.46709		ST, FC		ST					ST			
18	178.4	38.88876	-92.47822	ST	FC		ST, FC		ST, FC						
19	180.3	38.91222	-92.48511				ST, FC	ST, FC			ST, FC			ST, FC	ST, FC
20	181.7	38.92682	-92.50267				ST, FC					ST, FC		ST, FC	
21	183.3	38.94314	-92.52277							ST, FC	ST, FC	ST, FC			
22	184.8	38.95739	-92.54290		FC					ST, FC					

Appendix I. (continued)

Bend Number	Bend RM	Coordinates Lat	Long	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
23	186.9	38.97161	-92.57248	FC		ST		ST, FC							
24	189.1	38.96944	-92.61167	FC		ST		ST, FC				ST, FC	ST, FC		
25	191.9	38.97657	-92.66182	ST	FC		ST, FC		ST, FC		ST, FC				ST, FC
26	193.8	38.97720	-92.69648	ST	FC			ST, FC	ST, FC						ST, FC
27	197.2	38.97838	-92.75536	ST					ST, FC				ST, FC		
28	199.6	38.97331	-92.79757	ST			ST, FC								
29	201.2	38.97869	-92.82595	ST, FC									ST, FC		ST, FC
30	203.8	38.99286	-92.86725	ST	ST		ST, FC		ST, FC			ST, FC	ST, FC	ST, FC	
31	205.5	39.00777	-92.89094			ST			ST, FC				ST, FC		
32	207.3	39.02308	-92.91510	ST		FC			ST, FC	ST, FC					
33	209.3	39.04874	-92.92946	ST					ST, FC	ST, FC		ST, FC			
34	211.0	39.06991	-92.92619			ST, FC				ST, FC	ST, FC			ST, FC	ST, FC
35	214.0	39.09772	-92.91600	ST			ST, FC							ST, FC	
36	217.5	39.12863	-92.93490	FC			ST, FC			ST, FC	ST, FC				
37	220.1	39.15083	-92.90565	FC	ST					ST, FC					
38	222.5	39.18126	-92.88823		ST, FC			ST, FC						ST, FC	ST, FC
39	228.3	39.23412	-92.87000		ST, FC	FC		ST, FC					ST, FC		ST, FC
40	232.3	39.24127	-92.91920									ST			ST, FC
41	234.4	39.26480	-92.92936												ST, FC
42	236.9	39.28693	-92.95833			ST, FC					ST, FC		ST, FC		
43	239.6	39.31535	-92.97281							ST, FC	ST, FC	ST		ST, FC	
44	246.3	39.34550	-93.07668				ST, FC		ST, FC			ST			
45	250.3	39.38247	-93.11111												